

CONTRACT REQUIREMENTS

Exhibit E, Para 5.10

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Apollo Mission Planning Task Force

PHASE I PROGRESS REPORT

T. G. Barnes
Prepared by AMPTF
T. G. Barnes, Chairman

E. Stern
Checked by
E. Stern, Head, LEM Systems
Analysis & Integration

A. B. Whitaker
Approved by
A. B. Whitaker, LEM Systems
Project Engineer

Assembled by
Grumman Aircraft Engineering Corporation
Bethpage, New York

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A. APPENDIX

A-1 INTRODUCTION

At the request of the Apollo Spacecraft Program Office, Grumman has initiated a special study of the mission requirements associated with the entire lunar landing mission. This document is Volume III of the Progress Report on the results to date.

The principal objectives of the overall study are to:

- o Determine the mission-related, functional requirements for the spacecraft subsystems, and examine the present subsystem capabilities relative to these functional requirements for both nominal and contingency situations.
- o Evaluate the capability of the spacecraft to fly missions which meet the program mission objectives and determine the flexibilities available within the established control weights.
- o Provide the program with mission plans which can be the basis for other analyses and reporting.

This study is intended to answer the question, "Are the functional requirements to which the spacecraft is being designed adequate for the Apollo Program objectives and consistent between modules?"

As one means of studying the operational adequacy of the spacecraft design, it is intended to develop a detailed description of the sequence of events of a mission - a preliminary Reference Mission. The purpose of the Reference Mission is to provide a framework for a time-line study of the spacecraft and its systems which, in return, will reveal possible inconsistencies in operating capabilities. This mission description will include the operations from VAB Rollout through Retrieval, and the functional relationships between MSFN and the space vehicle.

Section 4, Volume I, of this report describes the approach being taken to the study of the Reference Mission. This volume summarizes the progress to date on the development of a reference sequence of events.

A-2 REFERENCE MISSION DESCRIPTION PROGRESS SUMMARY

Since the performance aspects of the Reference Mission are secondary, a launch date and trajectory were recommended by MSC and adopted early in the study so that development of the sequence of events could proceed. The highlights of the Reference Mission are that launch will be in daylight on 6 May 1968, and the 90,000-lb spacecraft is injected into a 66.4-hr translunar-coast-free-return trajectory. The lunar landing is in sunlight at $1^{\circ}28'W/0^{\circ}30'S$ selenographic coordinates. After a lunar surface stay of 24.2 hr, the spacecraft is injected into a 92.4-hr transearth trajectory, which results in a daylight landing in the designated recovery area near Hawaii. A time and weight breakdown by major mission phases is shown in Table A-1.

Table A-2 lists the abbreviations which have been used in preparing the sequence of events. Table A-3 presents the current status of the development of this sequence. The ground rules and assumptions which were used in preparing this work are shown in Sections 3, 4.2.2.1, and 4.3.2, in Volume I. The principal assumptions shown in 4.3.2 are repeated below:

- o The times indicated for the S-IVB vent cycles were selected arbitrarily and will be adjusted as data become available.
- o The times indicated for the assumed four navigation sightings during earth orbit were selected so as not to conflict with the S-IVB vent cycles, and were scheduled to occur in daylight.
- o All CSM navigation sightings are landmark observations.
- o At least 20 min is required following a last navigation sighting in earth orbit and prior to thrust initiation for TLI to perform the required operations.
- o Communications during earth orbit indicate MSFN availability and not necessarily CSM crew participation with MSFN.
- o The crew members do not enter LEM until passage through the outer Van Allen Belt.
- o CM ECS has the capability to pressurize the interlock and LEM cabin following transposition and prior to separation. It shall also have the capability to pressurize the interlock alone when final docking is accomplished.

- o LEM/CSM umbilical connection is made following transposition and docking and provides the hard-line connection for accomplishing S-IVB separation, and provides a voice link for communication during translunar and lunar orbit LEM checkout.
- o A LEM translunar checkout is assumed. However, the desirability of this checkout is currently under study. Therefore, the description of the lunar orbit checkout assumes that no translunar check was performed. This results in duplication of system events in the time-line, which are noted in the text (e.g., deployment of landing gear).
- o Only one crew member transfers into LEM to perform the translunar checkout.
- o The probe and drogue are carried in the installed position in the interlock during translunar flight following LEM checkout.
- o The CM IMU is placed on standby during portions of the translunar and transearth coast phases. (It is operated during all midcourse corrections and prior to the first and after the last in the translunar phase and after the last in the transearth phase.)
- o Doff and don cycles have been arbitrarily selected and have not yet been optimized.
- o The transearth and translunar sleep cycles are based on no one crew member being awake more than 18 hrs.
- o The translunar sleep cycle provides that the two LEM crew members are the last to sleep prior to LOI.
- o CSM IMU alignments are required prior to all main propulsion ΔV phases.
- o CSM navigation sightings during lunar orbit were confined to $\pm 60^\circ$ longitudes because of poorer landmark accuracy in the outer lunar longitudes.
- o Six navigational sightings are employed in lunar orbit between LOI and LEM separation. (Ten navigation sightings are provided during CSM solo operations.)
- o Prior to separation, LEM SCS is turned on in the direct mode. Use of this mode will not result in conflicting torques with respect to the CSM's attitude-hold mode of operation.

- o Two LEM IMU alignments are performed prior to separation using the LGC for both coarse and fine alignment primarily as an equipment checkout.
- o LEM is active during the separation and docking maneuvers in lunar orbit. Modes are manual. LEM separates to a distance of 500 ft.
- o Immediately after separation, the LEM rendezvous and landing radars track the CSM primarily as an equipment checkout.
- o The LEM rendezvous radar is deactivated immediately prior to powered descent.
- o The CSM radar tracks LEM from separation throughout LEM descent to touchdown.
- o The mode of flight control from LEM hover-to-touchdown is not specified. However, it is assumed that automatic, semiautomatic, and manual modes are available for descent rate, translation, and attitude control.
- o The LEM descent engine shutdown occurs at 5 ft altitude.
- o There will be two PLSS units in LEM. They will be filled with water in lunar orbit prior to LEM separation. The initial electrical and oxygen charge will be accomplished prior to earth launch.
- o There will be one PLSS unit in the CM. It will be fully charged (electrical, oxygen, water) prior to earth launch.
- o Both PLSS units in LEM shall be fully charged prior to normal lunar launch.
- o Only one PLSS unit may be charged at a time.
- o Recharging of either PLSS may extend into the lunar prelaunch preparation phase or overlap a sleep period.
- o Only one crew member at a time is permitted on the lunar surface during normal operation.
- o During lunar surface operations, only one LEM crew member at a time is permitted sleep during rest periods while the other must remain on duty.

- o A crew member leaving LEM for normal exploration must have a fully charged PLSS.
- o The minimum planned continuous sleep periods for each crew member, when on the lunar surface, are 4 hr. An additional 45 min of rest is provided for each member prior to start of the lunar prelaunch preparation phase.
- o Normal repressurization of the LEM cabin, when both crew members are inside the vehicle, will be from the gaseous oxygen tank.
- o Normal repressurization of the LEM cabin, when one crew member is on the lunar surface and the other is in the LEM, will be from the supercritical oxygen tank.
- o For the LEM lunar prelaunch preparation phase, 100 min is allotted, requiring that both crew members be awake.
- o LEM and CSM mutually radar-track each other during the CSM's first pass over the landing site after LEM touchdown and during the last pass over the site prior (2 hr) to LEM liftoff.
- o Immediately prior to launch, LEM and CSM mutually track each other. The LEM radar is deactivated just prior to ascent engine ignition. The CSM shall track LEM from liftoff through docking. However, the LEM rendezvous radar tracks the CSM immediately after ascent engine burnout through docking.
- o The LEM crew updates the LGC's knowledge of the CSM ephemeris at the last pass (2 hr) prior to launch.
- o LEM IMU is aligned prior to the CSM's last pass before launch.
- o The LEM ascent propulsion system is not pressurized until the lunar prelaunch preparation phase.
- o The LEM cabin shall be pressurized to 5.0 psia prior to normal launch.
- o LEM ascent engine ignition and descent staging occur essentially simultaneously.
- o LEM RCS is used for all LEM midcourse corrections and rendezvous.

- o LEM rendezvous scheme provides thrust at 5.0, 1.5, and 0.25 n mi range to CSM.
- o Docking begins at approximately 500 ft range to CSM.
- o LEM jettison is accomplished with the SM RCS.
- o The last transearth correction is performed 2 hr before entry.
- o The question of constraints on navigation sightings because of the sun's position during translunar and transearth phases, has not been considered. For example, the three sightings after the last transearth correction occur to a dark earth.

The time-line format in Table A-3 is divided into three columns. The left column is for CSM crew activities and equipment functions; the middle column is for mission time (in hours, minutes, and seconds) and is cumulative starting at zero (00:00:00) for liftoff, and ending at touchdown at 196 hr, 18 min, and 17 sec (198:18:17); the right column is for LEM crew activities and equipment functions. The items in capital letters are events which are either instantaneous occurrences or the start and/or completion of a crew activity or equipment function. If a time is noted in parentheses adjacent to the event, it indicates the duration of the event. If no time is noted, it either indicates a point in time or that the time duration is unknown. It is not necessary that an event be completed before another event be initiated. Overlap of events indicate that, initially, the active crew members will perform the prevalent event. If a new event begins prior to completion of the initial event, the active crew members will either perform the new event simultaneously (depending on the importance of the event) or time-share both events.

The items in lower case letters are operational sequences which are the crew activities or equipment functions necessary to perform the event. If a time is noted adjacent to the operational sequence it also indicates the duration of the operational sequence.

The crew members are identified as follows:

Astronaut No. 1 - Systems Engineer (LEM and CSM)

Astronaut No. 2 - Navigator (CSM)

Astronaut No. 3 - Commander (LEM and CSM)

Table A-1
Reference Mission, Consumables Not Expended,
Launch 6 May 1968 at 1:32 P. M. Local Time

PHASE NUMBER		WEIGHT * (LB)	ELAPSED TIME * (HR)	PHASE TIME (MIN)	ISP. (SEC)	CHARAC VEL (F/S)	PROPELLANT USED (LB)
1.0	PREFLIGHT						
1.1	SPACEVEHICLE PRELAUNCH POSITIONING	6000000.00	.456.000				
1.2	PRELAUNCH CHECKOUT	6000000.00	.444.000	720.00	.00	.00	.00
1.3	LAUNCH COUNTDOWN	6000000.00	.12.000	25920.00	.00	.00	.00
				720.00	.00	.00	.00
2.0	EARTH ASCENT (LIFT-OFF THRU EARTH ORBIT INSERT.)						
2.1	LIFT-OFF THRU S-IC JETTISON						
2.1.1	S-IV THRUSTING	6000000.00	.000				
	JETTISON S-IC	1737423.80	.041	2.51	283.51	11305.03	4262576.20
2.2	S-IC JETTISON(JET. LES+INTERSTAGE)THRU S-II JET.						
2.2.1	S-II THRUSTING	1384355.80	.042	.58	426.00	472.88	46948.50
2.2.2	JETTISON LES + INTERSTAGE	1337407.30	.052	.00	.00	.00	.00
2.2.3	CONTINUE S-II THRUSTING	1321357.30	.052	.00	.00	.00	.00
2.2.4	JETTISON S-II	463149.88	.150	5.84	426.00	14369.02	858207.50
2.3	S-II JETTISON THRU EARTH PARKING ORBIT INSERTION (S-IVB THRUSTING, FIRST BURN)	360247.16	.150	.05	.00	.00	.00
				2.81	426.00	3411.51	79378.73
3.0	EARTH PARKING ORBIT						
3.1	ORBIT INSERTION TO TLI DECISION						
3.1.1	INITIAL COAST TO VENT 1	280868.43	.197				
3.1.2	S-IVB ULLAGE - VENT 1 **	280868.43	.697	30.00	.00	.00	.00
3.1.3	CONTINUE COAST TO VENT 2	280318.43	.697	.00	.00	.00	.00
3.1.4	S-IVB ULLAGE - VENT 2	280318.43	1.197	30.00	.00	.00	.00
3.1.5	CONTINUE COAST TO VENT 3	279768.43	1.197	.00	.00	.00	.00
3.1.6	S-IVB ULLAGE - VENT 3	279768.43	1.697	30.00	.00	.00	.00
3.1.7	CONTINUE COAST TO VENT 4	279218.43	1.697	.00	.00	.00	.00
3.1.8	S-IVB ULLAGE - VENT 4	279218.43	2.197	30.00	.00	.00	.00
3.1.9	CONTINUE COAST TO TLI DECISION	278668.43	2.197	.00	.00	.00	.00
3.2	TLI DECISION TO S-IVB IGNITION						
3.2.1	BEGIN TLI PREPARATION	278668.43	2.391	11.64	.00	.00	.00
3.2.2	S-IVB ULLAGE - VENT 5	278668.43	2.697	18.35	.00	.00	.00
3.2.3	CONTINUE TLI PREPARATION	278118.43	2.697	.00	.00	.00	.00
3.2.4				4.92	.00	.00	.00
4.0	TRANSLUNAR INJECTION(S-IVB THRUSTING, SECOND BURN)	278118.43	2.779	5.24	426.00	10380.98	147712.72
5.0	INITIAL TRANSLUNAR COAST THRU S-IVB JETTISON						
5.1	INITIAL COAST TO TRANS. THRU DEPLOY. FWD ADAP.	130405.71	2.867				
5.2	TRANSPOSITION + DOCKING	130405.71	3.113	14.75	.00	.00	.00
5.3	DOCKING THRU S-IVB JETTISON	130405.71	3.446	20.00	.00	.00	.00
				5.00	.00	.00	.00
6.0	S-IVB JETTISON TO LUNAR ORBIT INSERTION						
6.1	COAST THRU FIRST MCC						
6.1.1	COAST TO FIRST MCC	86600.00	3.529				
6.1.2	FIRST MIDCOURSE CORRECTION	86600.00	12.529	540.00	.00	.00	.00
6.2	COAST THRU SECOND MCC						
6.2.1	COAST TO SECOND MCC	85744.31	12.533	.20	313.00	100.00	855.68
6.2.2	SECOND MIDCOURSE CORRECTION	85744.31	44.680	1928.79	.00	.00	.00
6.3	COAST THRU THIRD MCC						
6.3.1	COAST TO THIRD MCC	84897.08	44.683	.20	313.00	100.00	847.23
6.3.2	THIRD MIDCOURSE CORRECTION	84897.08	67.996	1398.76	.00	.00	.00
6.4	PREPARATION FOR LUNAR ORBIT INSERTION	84058.22	67.999	.20	313.00	100.00	838.86
				77.95	.00	.00	.00
7.0	LUNAR ORBIT INSERTION	84058.22	69.298	5.39	313.00	3157.60	22624.46
8.0	LUNAR ORBIT COAST TO LEM SEPARATION						
8.1	LUNAR ORBIT COAST	61433.75	69.388	108.78	.00	.00	.00
8.2	PREPARATION FOR LEM SEPARATION	61433.75	71.201	96.00	.00	.00	.00

* At the beginning of the phase.

** In the trajectory calculation, each S-IVB vent cycle was assumed to add 4 fps in the flight direction. This has been neglected in the table.

Table A-1 (cont)
Reference Mission, Consumables Not Expended,
Launch 6 May 1968 at 1:32 P.M. Local Time

PHASE NUMBER		WEIGHT * (LB)	ELAPSED TIME * (HR)	PHASE TIME (MIN)	ISP (SEC)	CHARAC VEL (F/S)	PROPELLANT USED (LB)
9.0	CSM LUNAR ORBITAL OPERATIONS						
9.1	LEM/CSM SEPARATION	61433.75	72.801				
9.2	LUNAR ORBIT COAST (TO PHASE 13.0)	31563.75	73.301	30.00	.00	.00	.00
10.0	LEM DESCENT			1594.61			
10.1	LEM/CSM SEPARATION + PREPARATION FOR DESCENT						
10.1.1	LEM/CSM SEPARATION	29870.00	72.801				
10.1.2	PREPARED FOR DESCENT	29854.26	72.823	1.30	295.00	5.00	15.73
10.2	TRANSFER ORBIT INSERTION	29854.26	73.301	28.70	.00	.00	.00
10.3	COAST TO INITIATION OF POWERED DESCENT	29582.08	73.303	.13	301.00	88.70	272.18
10.4	POWERED DESCENT TO HOVER	29582.08	74.268	57.91	.00	.00	.00
10.5	HOVER TO TOUCHDOWN	15854.83	74.397	7.73	301.00	6040.10	13727.25
11.0	LEM LUNAR STAY			2.00	301.00	636.30	1008.23
11.1	POST LANDING CHECKOUT	14846.59	74.431				
11.2	LUNAR EXPLORATION	14846.59	75.681	75.00	.00	.00	.00
11.3	PRELAUNCH PREPARATION	14846.59	96.952	1276.26	.00	.00	.00
12.0	LEM ASCENT			100.00	.00	.00	.00
12.1	POWERED ASCENT TO TRANSFER ORBIT INSERTION	10500.00	98.618				
12.2	COAST TO TERMINAL RENDEZVOUS			7.03	306.00	6067.60	4830.62
12.2.1	COASTING LUNAR ASCENT TO FIRST MCC	5669.37	98.736				
12.2.2	FIRST MIDCOURSE CORRECTION	5669.37	98.886	9.00	.00	.00	.00
12.2.3	COAST TO SECOND MCC	5649.10	98.894	.48	295.00	34.00	20.27
12.2.4	SECOND MIDCOURSE CORRECTION	5649.10	99.119	13.52	.00	.00	.00
12.2.5	COAST TO THIRD MCC	5642.55	99.122	.15	295.00	1.00	6.54
12.2.6	THIRD MIDCOURSE CORRECTION	5642.55	99.286	9.84	.00	.00	.00
12.2.7	COAST TO TERMINAL RENDEZVOUS	5639.58	99.287	.07	295.00	5.00	2.97
12.3	TERMINAL RENDEZVOUS			12.91	.00	.00	.00
12.3.1	FIRST THRUSTING	5639.58	99.502	.58	295.00	42.00	24.90
12.3.2	COAST TO SECOND THRUSTING	5614.68	99.512	2.95	.00	.00	.00
12.3.3	SECOND THRUSTING	5614.68	99.561	.98	295.00	71.00	41.84
12.3.4	COAST TO THIRD THRUSTING	5572.84	99.577	2.83	.00	.00	.00
12.3.5	THIRD THRUSTING	5572.84	99.625	.18	295.00	13.00	7.62
12.4	DOCKING	5565.21	99.628	15.00	295.00	25.00	14.63
13.0	LUNAR ORBIT COAST TO TEI						
13.1	COAST THRU CREW TRANSFER	37114.33	99.878				
13.2	COAST TO LEM JETTISON	37114.33	100.378	30.00	.00	.00	.00
13.3	TRANSEARTH INJECTION PREPARATION			10.00	.00	.00	.00
13.3.1	JETTISON LEM	37114.33	100.544				
13.3.2	COAST TO TEI PREPARATION	32153.75	100.566	1.30	.00	.00	.00
13.3.3	TEI PREPARATION	32153.75	102.986	145.17	.00	.00	.00
14.0	TRANSEARTH INJECTION	32153.75	103.486	30.00	.00	.00	.00
15.0	TRANSEARTH COAST			1.88	313.00	2853.00	7932.61
15.1	COAST THRU FIRST MCC						
15.1.1	COAST TO FIRST MCC	24221.14	103.517	1070.07	.00	.00	.00
15.1.2	FIRST MIDCOURSE CORRECTION	24221.14	121.352	.05	313.00	100.00	239.32
15.2	COAST THRU SECOND MCC						
15.2.1	COAST TO SECOND MCC	23981.81	121.352				
15.2.2	SECOND MIDCOURSE CORRECTION	23981.81	168.501	2828.88	.00	.00	.00
15.3	COAST THRU THIRD MCC						
15.3.1	COAST TO THIRD MCC	23744.85	168.501	.05	313.00	100.00	236.96
15.3.2	THIRD MIDCOURSE CORRECTION	23744.85	193.586	1505.04	.00	.00	.00
15.4	THIRD MCC THRU SM JETTISON						
15.4.1	COAST TO SM JETTISON	23510.23	193.586	.05	313.00	100.00	234.62
15.4.2	JETTISON SM	23510.23	195.522	116.12	.00	.00	.00
15.5	SM JETTISON TO ENTRY	9500.00	195.544	1.30	.00	.00	.00
				20.00	.00	.00	.00
16.0	ENTRY(400,000FT ALT TO DROGUE CHUTE DEPLOYMENT)	9500.00	195.877	14.97	.00	.00	.00
17.0	PARACHUTE DESCENT(DROGUE DEPLOY TO TOUCHDOWN)	9500.00	196.127	10.67	.00	.00	.00
18.0	POST LANDING THRU SPACECRAFT RETRIEVAL	8624.00	196.305				

* At beginning of phase

Table A-2
Abbreviations

AGC	Apollo Guidance Computer	LES	Launch Escape System
AOT	Alignment Optical Telescope	LGC	LEM Guidance Computer
ARS	Atmosphere Revitalization Section	LIOH	Lithium Hydroxide
BUGS	Backup Guidance System	LOI	Lunar Orbit Insertion
C	Commander	LOS	Line-of-Sight
CES	Crew Equipment System	MCC	Midcourse Correction
CM	Command Module	NSIF	Near Space Instrumentation Facility
C/S	Commander and Systems Engineer	PCM	Pulse Code Modulation
CSM	Command and Service Modules	PLSS	Portable Life Support System
CM-RCS	Command Module-Reaction Control System	PNGS	Primary Navigation Guidance System
C&I	Communication & Instrumentation System	RCS	Reaction Control System
DSIF	Deep Space Instrumentation Facility	S	System Engineer
ECS	Environmental Control System	S/C	Spacecraft
ELS	Earth Landing System	SCS	Stabilization & Control System
EPS	Electrical Power System	SM	Service Module
FC	Flight Control	SM-RCS	Service Module-Reaction Control System
FDAI	Flight Direction Attitude Indicator	SOX	Supercritical Oxygen
GOSS	Ground Operational Support System (MSFN)	SPS	Service Propulsion System
G&N	Guidance & Navigation System	TEI	Transearth Injection
IFTS	In-Flight Test System	TLI	Translunar Injection
IMU	Inertial Measurement Unit	T/M	Telemetry
LEM	Lunar Excursion Module		

CSM	<i>h:m:s</i>	LEM
1. 0 <i>Preflight</i>		
<i>2. 0 Earth Ascent (Liftoff thru Earth Orbit Insertion)</i>		
2. 1 <i>Liftoff thru S-IC Jettison</i>		
2. 1. 1 <i>S-IC Thrusting</i>		
LIFTOFF	00:00:00	
Liftoff operations	00:00:11	
ROLL AND PITCHOVER MANEUVERS		
Launch azimuth correction		
Pitchover maneuver		
2. 1. 2 <i>Jettison S-IC</i>		
S-IC ENGINE CUTOFF	00:02:25	
S-IC engine cutoff operation		
S-II ULLAGE ROCKET IGNITION	00:02:26	
S-II ullage rocket operation		
S-IC RETROROCKET IGNITION	00:02:27	
S-IC retrorocket operation		
S-IC SEPARATION	00:02:28	
2. 2 <i>S-IC Jettison (Jettison Launch Escape System & Interstage) thru S-II Jettison</i>		
2. 2. 1 <i>S-II Thrusting</i>		
S-II ENGINE IGNITION	00:02:31	
S-II engine operation		

CSM	<i>h:m:s</i>	LEM
<i>2.2.2 Jettison Launch Escape System & Interstage</i>		
LES TOWER JETTISON SEQUENCE LES tower jettison operation	00:03:03	
<i>2.2.3 Continue S-II Thrusting</i>		
S-II POWERED ASCENT Post-LES tower jettison operation	00:03:03	
<i>2.2.4 Jettison S-II</i>		
S-II ENGINE CUTOFF S-II engine cutoff operation	00:08:57	
S-IVB ULLAGE ROCKET IGNITION	00:08:58	
S-IVB ullage rocket operation		
S-II RETROROCKET IGNITION	00:08:59	
S-II retrorocket operation		
S-II SEPARATION	00:09:00	
S-II separation sequence		
<i>2.3 S-II Jettison thru Earth Parking Orbit Insertion (S-IVB Thursting, First Burn)</i>		
S-IVB ENGINE IGNITION	00:09:04	
S-IVB engine operation		
S-IVB ENGINE CUTOFF	00:11:49	
S-IVB engine cutoff operation		

CSM	<i>h:m:s</i>	LEM
<i>3.0 Earth Parking Orbit</i>		
<i>3.1 Orbit Insertion to Translunar Injection Decision</i>		
<i>3.1.1 Initial Coast to Vent 1</i>		
START ORBIT CHECK Orbit establishment operations Crew safety check Orbital parameters determined ACQUIRE GOSS COMMUNICATION (Bermuda & Atlantic Ship) C-band tracking Up data link Two-way voice Unified S-band PCM-T/M	00:11:49	00:12:00
LOSE GOSS COMMUNICATION (Bermuda) START S/C SYSTEMS CHECK (00:27:00) IFTS, G&N, SCS, EPS, ECS, C&I, SPS, SM-RCS, CM-RCS	00:12:36	00:15:00
LOSE GOSS COMMUNICATION (Atlantic Ship) ACQUIRE GOSS COMMUNICATION (Canary Island) C-band tracking PCM-T/M	00:15:36	00:17:24

CSM	h:m:s	LEM
<i>3.1.1 Initial Coast to Vent 1 (cont)</i>		
Up data link		
Two-way voice		
Unified S-band		
ENTER DARKNESS	00:22:36	
LOSE GOSS COMMUNICATION (Canary Island)	00:23:24	
<i>3.1.2 S-IVB Ullage-Vent 1</i>		
FIRST VENTING ULLAGE	00:40:19	
<i>3.1.3 Continue Coast to Vent 2</i>		
VERIFY COMPLETION OF S-IVB VENT	00:43:19	
ACQUIRE GOSS COMMUNICATION	00:53:24	
(Carnarvon)		
C-band tracking		
PCM-T/M		
Up data link		
Two-way voice		
Unified S-band		
BEGIN IMU ALIGNMENT (00:12:00)	00:54:00	
IMU fine alignment		
SCS attitude alignment		
IMU fine alignment		

<i>CSM</i>	<i>h:m:s</i>	<i>LEM</i>
LOSE GOSS COMMUNICATION (carnarvon) START NAVIGATIONAL SIGHTING (00:05:00)	00:57:36 01:05:19	
Perform navigational sighting Determine trajectory error & ephemeris miss-distance data w/o GOSS verification		
ENTER DARKNESS	01:06:48	
<i>3.1.4 S-IVB Ullage-Vent 2</i>		
SECOND VENTING ULLAGE	01:10:19	
<i>3.1.5 Continue Coast to Vent 3</i>		
VERIFY COMPLETION OF S-IVB VENT START NAVIGATIONAL SIGHTING (00:12:00)	01:13:19 01:15:00	
Perform navigational sighting Determine trajectory error & ephemeris miss-distance data w/o GOSS verification		
ACQUIRE GOSS COMMUNICATION (Guaymas)	01:29:24	
PCM-T/M Up data link Two-way voice Unified S-band C-band tracking		
ACQUIRE GOSS COMMUNICATION (California) PCM-T/M	01:30:36	

<i>CSM</i>	<i>h:m:s</i>	<i>LEM</i>
<i>3.1.5 Continue Coast to Vent 3 (cont)</i>		
Up data link		
Two-way voice		
Unified S-band		
C-band tracking		
LOSE GOSS COMMUNICATION (California)	01:31:12	
START NAVIGATIONAL SIGHTING (00:12:00)	01:32:25	
Perform navigational sighting		
Determine trajectory error & ephemeris miss-distance data		
ACQUIRE GOSS COMMUNICATION (Eglin)	01:34:48	
PCM-T/M		
Up data link		
Two-way voice		
Unified S-band		
C-band tracking		
LOSE GOSS COMMUNICATION (Guaymas)	01:35:24	
ACQUIRE GOSS COMMUNICATION (Cape Kennedy)	01:36:00	
PCM-T/M		
Up data link		
Two-way voice		
Unified S-band		
C-band tracking		

CSM	<i>h:m:s</i>	LEM
<i>3.1.5 Continue Coast to Vent 3 (cont)</i>		
ACQUIRE GOSS COMMUNICATION (Bermuda)	01:39:36	
PCM-T/M		
Up data link		
Two-way voice		
Unified S-band		
C-band tracking		
<i>3.1.6 S-IVB Ullage-Vent 3</i>		
THIRD VENTING ULLAGE	01:40:19	
<i>3.1.7 Continue Coast to Vent 4</i>		
VERIFY COMPLETION OF S-IVB VENT	01:40:19	
LOSE GOSS COMMUNICATION (Eglin)	01:40:48	
LOSE GOSS COMMUNICATION (Cape Kennedy)	01:42:00	
ACQUIRE GOSS COMMUNICATION (Atlantic Ship)	01:43:48	
START NAVIGATIONAL SIGHTING (00:12:00)	01:45:06	
Perform navigational sighting		
Determine trajectory error & ephemeris		
miss-distance data		
LOSE GOSS COMMUNICATION (Bermuda)	01:45:48	

CSM	<i>h:m:s</i>	LEM
<i>3.1.7 Continue Coast to Vent 4 (cont)</i>		
LOSE GOSS COMMUNICATION (Atlantic Ship)	01:49:12	
BEGIN SYSTEMS CHECK (00:10:00)	01:50:00	
IPTS, EPS, ECS, C&I, SM-RCS		
ACQUIRE GOSS COMMUNICATION (Canary)	01:51:36	
C-band tracking		
PCM-T/M		
Up data link		
Two-way voice		
Unified S-band		
ENTER DARKNESS	01:51:00	
LOSE GOSS COMMUNICATIONS (Canary)	01:55:12	
<i>3.1.8 S-IVB Ullage-Vent 4</i>		
FOURTH VENTING ULLAGE	02:10:19	
<i>3.1.9 Continue Coast to Translunar Injection Decision</i>		
VERIFY COMPLETION OF S-IVB VENT	02:13:19	
BEGIN CES OPERATIONS (00:10:00)	02:13:30	
Prepare & ingest food		

CSM	<i>h.m.s</i>	LEM
<i>3.2 Translunar Injection Decision to S-IVB Ignition</i>		
<i>3.2.1 Begin Translunar Injection Preparation</i>		
START S/C PREPARATION FOR TLI (00:18:00)	02:23:28	
TLI parameter data acquisition		
IMU fine alignment		
SCS attitude alignment		
IMU fine alignment check		
G&N, SCS, & CES		
ACQUIRE GOSS COMMUNICATION (Carnarvon)	02:26:24	
C-band tracking		
PCM-T/M		
Up data link		
Two-way voice		
Unified S-band		
LOSE GOSS COMMUNICATION (Carnarvon)	02:31:48	
ENTER DAYLIGHT	02:35:12	
<i>3.2.2 S-IVB Ullage-Vent 5</i>		
FIFTH VENTING ULLAGE	02:40:19	
<i>3.2.3 Continue Translunar Injection Preparation</i>		
SM-RCS PREPARATION FOR INJECTION	02:42:00	
ATTITUDE MANEUVER	02:42:44	

CSM	<i>h:m:s</i>	<i>LEM</i>
<i>3.2.3 Continue Translunar Injection Preparation (cont)</i>		
VERIFY COMPLETION OF S-IVB VENT S-IVB ULLAGE ACCELERATION FOR TLI	02:43:19 02:46:41	
<i>4.0 Translunar Injection (S-IVB Thrusting, Second Burn)</i>		
S-IVB PROPULSION SYSTEM IGNITION (00:05:18) ACQUIRE GOSS COMMUNICATION (Hawaii) C-band tracking PCM-T/M Up data link Two-way voice Unified S-band S-IVB PROPULSION SYSTEM CUTOFF	02:46:44 02:51:36 02:52:02	
<i>5.0 Initial Translunar Coast thru S-IVB Jettison</i>		
<i>5.1 Initial Coast to Transposition thru Deployment of Forward Adapter</i>		
S-IVB PROPULSION SYSTEM CUTOFF Post-injection check Post-delta-V EPS check LOSE GOSS COMMUNICATIONS (Guaymas) ACQUIRE GOSS COMMUNICATION (California)	02:52:02 02:56:24 02:56:24	

CSM	<i>h:m:s</i>	LEM
<i>5.1 Initial Coast to Transposition thru Deployment of Forward Adapter (cont)</i>		
START SYSTEMS CHECK (00:35:00)	02:57:00	
Initial CES operation		
IFTS, G&N, SCS, EPS, ECS, SPS, SM-RCS, CM-RCS		
CSM-LEM/S-IVB separation preparation		
SCS attitude alignment		
Communicate systems status to GOSS		
ACQUIRE GOSS COMMUNICATION (Austin)	02:58:12	
ACQUIRE GOSS COMMUNICATION (Eglin)	02:59:24	
LOSE GOSS COMMUNICATION (Hawaii)	03:00:36	
ACQUIRE GOSS COMMUNICATION (Cape Kennedy)	03:01:12	
ACQUIRE GOSS COMMUNICATION (Bermuda)	03:03:00	
ACQUIRE GOSS COMMUNICATION (Antigua)	03:04:48	
DEPLOYMENT OF S-IVB ADAPTER	03:06:29	
Monitor deployment of adapter		
<i>5.2 Transposition & Docking</i>		
CSM-LEM/S-IVB SEPARATION (00:10:00)	03:06:47	
CSM translation & pitch rotation		
ACQUIRE GOSS COMMUNICATION (Canary)	03:16:48	
CSM-LEM/S-IVB SOFT DOCKING	03:19:47	

<i>CSM</i>	<i>h:m:s</i>	<i>LEM</i>
<i>5.2 Transposition & Docking (cont)</i>		
INTERLOCK PRESSURIZATION (00:02:00)	03:19:47	
Pressurize interlock (00:01:00)	03:19:47	
Verify interlock pressure (00:01:00)	03:20:47	
CSM-LEM/S-IVB HARD DOCKING (00:05:00)	03:21:47	
Open CSM hatch		
Hard docking operation		
ACQUIRE GOSS COMMUNICATION (Madrid)	03:23:24	
<i>5.3 Docking thru S-IVB Jettison</i>		
CSM - LEM UMBILICAL CONNECTION (00:01:00)	03:26:47	
Close CSM hatch		
PREPARATION FOR S-IVB JETTISON (00:03:00)	03:27:47	
SEPARATION OF CSM-LEM FROM S-IVB (00:01:00)	03:30:47	
Monitor S-IVB jettison		
<i>6.0 S-IVB Jettison to Lunar Orbit Insertion</i>		
<i>6.1 Coast thru First Midcourse Correction</i>		
<i>6.1.6 Coast to First Midcourse Correction</i>		
S-BAND COMMUNICATION ACTIVATION (00:00:05)	03:31:44	
High gain antenna deployment		

<i>CSM</i>	<i>h:m:s</i>	<i>LEM</i>
<i>6.1.6 Coast to First Midcourse Correction (cont)</i>		
START S/C SYSTEMS CHECK (00:30:00) IFTS, G&N, SCS, EPS, ECS, SPS, SM-RCS, CM-RCS	03:36:44	
Fuel cell purge		
Entry batteries, post-landing battery, & PLSS battery charge	03:37:48	
LOSE GOSS COMMUNICATION (California)	03:37:48	
LOSE GOSS COMMUNICATION (Eglin)	03:37:48	
LOSE GOSS COMMUNICATION (Bermuda)	03:37:48	
START NAVIGATION (00:12:00)	04:06:44	
Navigational sighting (IMU on operate)		
Obtain present trajectory error & ephemeris miss-distance data	04:24:44	
START NAVIGATION (00:12:00)		
Navigational sighting (IMU on operate)		
Obtain present trajectory error & ephemeris miss-distance data		
INTERLOCK PRESSURIZATION CHECK (00:02:00)	04:34:00	
Interlock pressurization operation (00:01:00)	04:34:00	
Interlock leakage check operation (00:01:00)	04:35:00	

CSM	h:m:s	LEM
<i>6.1.6 Coast to First Midcourse Correction (cont)</i>		
REMOVE & STOW DOCKING MECHANISM (00:10:00)	04:36:00	
Open CSM hatch		
Removal & stowage operation of CSM probe in CM (00:05:00)	04:36:00	
Removal & stowage operation of LEM drogue in CM (00:05:00)	04:41:00	
	04:46:00	LEM CABIN PRESSURIZATION (00:05:00)
	04:46:00	Open cabin relief & dump valve (00:00:30)
	04:46:30	Pressurize cabin (00:02:30)
	04:49:00	Leak check cabin (00:02:00)
	04:51:00	TRANSFER SYSTEMS ENGINEER TO LEM (00:03:00)
	04:51:00	Open LEM hatch (00:01:00)
	04:52:00	Activate cabin lighting (00:00:30)
	04:52:30	Activate caution & warning system (00:00:30)
	04:53:00	Transfer to LEM cabin (00:01:00)
SYSTEMS CHECK (00:15:00) IFTS, G&N, SCS, EPS, ECS	04:53:15	
	04:54:00	ESTABLISH LEM CABIN HABITABILITY CONDITIONS (00:03:15)
	04:54:00	Check status of caution & warning system (00:00:30)
	04:54:30	Visually inspect cabin interior (00:01:00)
	04:55:30	Activate panel displays (00:01:00)

CSM	h:m:s	LEM
<i>Coast of [REDACTED]</i>		
	04:56:30	Perform initial check of ECS & bring to standby operation (00:00:15)
	04:56:45	Connect suit umbilical to ECS (00:00:15)
	04:57:00	Establish hard-line voice link with CSM (00:00:15)
	04:57:15	START LEM SYSTEMS CHECKOUT (01:26:45)
		Power generation
		Power distribution
		ECS
		CLOSE LEM hatch leaving cabin relief & dump valve open
		Deploy landing gear
		S-band communication
		VHF communication
		G&N
		FC
		SCS
		Ascent propulsion
		Descent propulsion
		RCS
		Programmed deactivation of LEM systems

<i>CSM</i>	<i>h:m:s</i>	<i>LEM</i>
<i>6.1.6 Coast to First Midcourse Correction (cont)</i>		
START NAVIGATION (00:12:00) Navigational sighting (IMU on operate) Obtain present trajectory error & ephemeris miss-distance data	05:13:15	
START NAVIGATION (00:12:00) Navigational sighting (IMU on operate) Obtain present trajectory error & ephemeris miss-distance data	05:31:15	
SYSTEMS CHECK (00:15:00) IFTS, G&N, SCS, EPS, ECS	05:53:15	
LOSE GOSS COMMUNICATION (Guaymas, Cape Kennedy, Antigua, Canary)	06:22:48	
	06:23:00	TRANSFER SYSTEMS ENGINEER TO CSM (00:02:00)
	06:23:00	Close cabin relief & dump valve & open LEM hatch (00:00:30)
	06:23:30	Transfer into interlock (00:00:30)
	06:24:00	Close LEM hatch (00:00:30)
	06:24:30	Transfer into CSM & close CSM hatch & valve (00:00:30)
	06:25:00	STOW PROBE & DROGUE IN INTERLOCK (00:08:00)
	06:30:00	SCS ATTITUDE ALIGNMENT (00:05:00)
	06:45:00	DOFF & STOW PRESSURE SUIT (00:15:00)

<i>CSM</i>	<i>h:m:s</i>	<i>LEM</i>
<i>6.1.6 Coast to First Midcourse Correction (cont)</i>		
SYSTEMS CHECK (00:15:00) IFTS, G&N, SCS, EPS, ECS BEGIN REST CYCLE (03:00:00)	06:53:15 07:00:00	
Astronaut No. 1 - rest		
Astronaut No. 2 - active		
Astronaut No. 3 - active		
LOSE GOSS COMMUNICATION (Madrid)		
SYSTEMS CHECK (00:25:00) IFTS, G&N, SCS, EPS, ECS, SPS, SM-RCS	07:10:48 07:38:15	
START NAVIGATION (00:12:00)	07:53:15	
Navigational sighting (IMU on operate)		
Obtain present trajectory error & ephemeris miss-distance data		
START NAVIGATION (00:12:00)	08:11:15	
Navigational sighting (IMU on operate)		
Obtain present trajectory error & ephemeris miss-distance data		
SYSTEMS CHECK (00:15:00) IFTS, G&N, SCS, EPS, ECS START NAVIGATION (00:12:00)	08:38:15 08:58:15	
Navigational sighting (IMU on operate)		
Obtain present trajectory error & ephemeris miss-distance data		

<i>6.1.6 Coast to First Midcourse Correction (cont)</i>	<i>CSM</i>	<i>h:m:s</i>	<i>LEM</i>
START NAVIGATION (00:12:00) Navigational sighting (IMU on operate) Obtain present trajectory error & ephemeris miss-distance data		09:16:15	
SCS ATTITUDE ALIGNMENT (00:05:00)		09:35:00	
SYSTEMS CHECK (00:20:00) IFTS, G&N, SCS, EPS, ECS Entry batteries, post-landing battery, & PLSS battery charge		09:38:15	
DOFF & DON PRESSURE SUITS (00:15:00)		09:45:00	
CONTINUE REST CYCLE (03:00:00) Astronaut No. 1 - active		10:00:00	
Astronaut No. 2 - active		10:17:24	
Astronaut No. 3 - rest			
ACQUIRE GOSS COMMUNICATION (Canberra)		10:38:15	
SYSTEMS CHECK (00:15:00)			
IFTS, G&N, SCS, EPS, ECS		10:53:15	
START NAVIGATION (00:12:00) Navigational sighting (IMU on operate) Obtain present trajectory error & ephemeris miss-distance data		11:11:15	
START NAVIGATION (00:12:00) Navigational sighting (IMU on operate) Obtain present trajectory error & ephemeris miss-distance data			

<i>CSM</i>	<i>h:m:s</i>	<i>LEM</i>
<i>6.1.6 Coast to First Midcourse Correction (cont)</i>		
START NAVIGATION (00:18:00) Navigational sighting (IMU on operate) Obtain present trajectory error & ephemeris miss-distance data Obtain next delta-V correction parameter data	11L38:00	
FIRST DELTA-V PREPARATION (00:35:00) IMU fine alignment SCS attitude alignment IMU fine alignment check SCS, G&N, CES, SM-RCS SM-RCS ullage acceleration	11:56:44	
<i>6.1.2 First Midcourse Correction</i>		
DELTA-V POWER PHASE (00:00:12) SPS firing	12:31:44	
<i>6.2 Coast thru Second Midcourse Correction</i>		
<i>6.2.1 Coast to Second Midcourse Correction</i>		
DELTA-V VERIFICATION (00:05:00) Confirm delta-V acquisition with GOSS SPS, SM-RCS securing after delta-V	12:31:55	

CSM	<i>h.m.s</i>	LEM
<i>6.2.1 Coast to Second Midcourse Correction (cont)</i>		
START S/C SYSTEMS CHECK (00:35:00) IFTS, G&N, SCS, EPS, ECS, SPS, SM-RCS, CM-RCS Carbon dioxide & odor absorber cartridge replaced	12:36:55	
Fuel cell purge		
Entry batteries, post-landing battery, & PLSS battery charge	12:37:00	
IMU TO STANDBY	13:00:00	
DOFF & DON PRESSURE SUITS (00:15:00)	13:15:00	
CONTINUE REST CYCLE (07:05:00)		
Astronaut No. 1 - active		
Astronaut No. 2 - rest		
Astronaut No. 3 - active		
START NAVIGATION (00:20:00)	13:17:24	
Navigation sighting (IMU on standby)		
Obtain present trajectory error & ephemeris miss-distance data		
SCS attitude alignment		
SYSTEMS CHECK (00:15:00)	13:36:43	
IFTS, G&N, SCS, ECS, EPS		
LOSE GOSS COMMUNICATION (Austin)	14:32:24	
SYSTEMS CHECK (00:15:00)	14:36:43	
IFTS, G&N, SCS, EPS, ECS		

<i>CSM</i>	<i>h:m:s</i>	<i>LEM</i>
<i>6.2.1 Coast to Second Midcourse Correction (cont)</i>		
START NAVIGATION (00:12:00) Navigational sighting (IMU on standby) Obtain present trajectory error & ephemeris miss-distance data	14:56:42	
SYSTEMS CHECK (00:27:00) IFTS, G&N, SCS, EPS, ECS Carbon dioxide & odor absorber cartridge replaced	15:36:43	
START NAVIGATION (00:20:00) Navigational sighting (IMU on standby) Obtain present trajectory error & ephemeris miss-distance data	15:56:42	
SCS attitude alignment		
SYSTEMS CHECK (00:25:00) IFTS, G&N, SCS, EPS, ECS, SPS, SM-RCS	16:36:43	
START NAVIGATION (00:12:00) Navigational sighting (IMU on standby) Obtain present trajectory error & ephemeris miss-distance data	17:31:44	
SYSTEMS CHECK (00:15:00) IFTS, G&N, SCS, EPS, ECS SYSTEMS CHECK (00:20:00) IFTS, G&N, SCS, EPS, ECS Entry batteries, post-landing battery, & PLSS battery charge	17:46:44 18:36:43	

CSM	h:m:s	LEM
<i>6.2.1 Coast to Second Midcourse Correction (cont)</i>		
START NAVIGATION (00:20:00) Navigational sighting (IMU on standby) Obtain present trajectory error & ephemeris miss-distance data SCS attitude alignment	19:31:44	
SYSTEMS CHECK (00:15:00) IFTS, G&N, SCS, EPS, ECS	19:51:43	
START CES OPERATIONS	19:51:43	
Prepare & ingest food		
DOFF & DON PRESSURE SUITS (00:15:00)	20:05:00	
ACQUIRE GOSS COMMUNICATION (Madrid)	20:17:24	
CONTINUE REST CYCLE (07:05:00)	20:20:00	
Astronaut No. 1 - rest		
Astronaut No. 2 - active		
Astronaut No. 3 - active	20:31:44	
START NAVIGATION (00:15:00) Navigational sighting (IMU on standby) Obtain present trajectory error & ephemeris miss-distance data		
SYSTEMS CHECK (00:22:00) IFTS, G&N, SCS, EPS, ECS, SPS, SM-RCS	20:46:44	
Fuel cell purge		
SYSTEMS CHECK (00:15:00) IFTS, G&N, SCS, EPS, ECS	21:36:43	

	CSM	h:m:s	LEM
<i>6.2.1 Coast to Second Midcourse Correction (cont)</i>			
START NAVIGATION (00:20:00)		22:01:44	
Navigational sighting (IMU on standby)			
Obtain present trajectory error & ephemeris miss-distance data			
SCS attitude alignment			
LOSE GOSS COMMUNICATION (Canberra)		22:17:24	
SYSTEMS CHECK (00:15:00)		22:36:43	
IPTS, G&N, SCS, EPS, ECS			
SYSTEMS CHECK (00:15:00)		23:36:43	
IPTS, G&N, SCS, EPS, ECS			
SYSTEMS CHECK (00:30:00)		24:36:43	
IPTS, G&N, SCS, EPS, ECS, SPS, SM-RCS, CM-RCS			
Entry batteries, post landing battery & PLSS battery charge			
START NAVIGATION (00:20:00)		25:01:44	
Navigational sighting (IMU on standby)			
Obtain present trajectory error & ephemeris miss-distance data			
SCS attitude alignment			
SYSTEMS CHECK (00:15:00)		25:36:43	
IPTS, G&N, SCS, EPS, ECS			
SYSTEMS CHECK (00:15:00)		26:36:43	
IPTS, G&N, SCS, EPS, ECS			
ACQUIRE GOSS COMMUNICATION (Austin)		27:17:24	

<i>CSM</i>	<i>h:m:s</i>	<i>LEM</i>
<i>6.2.1 Coast to Second Midcourse Correction (cont)</i>		
DOFF & DON PRESSURE SUITS (00:15:00)	27:25:00	
SYSTEMS CHECK (00:27:00)	27:36:43	
IPTS, G&N, SCS, EPS, ECS		
Carbon dioxide & odor absorber cartridge replaced		
CONTINUE REST CYCLE (07:20:00)	27:40:00	
Astronaut No. 1 - active		
Astronaut No. 2 - active		
Astronaut No. 3 - rest		
START CES OPERATIONS	27:41:42	
Prepare & ingest food	28:31:44	
START NAVIGATION (00:20:00)		
Navigational sighting (IMU on standby)		
Obtain present trajectory error & ephemeris miss-distance data		
SCS attitude alignment		
SYSTEMS CHECK (00:22:00)	28:51:43	
IPTS, G&N, SCS, EPS, ECS, SPS, SM-RCS		
Fuel cell purge		
SYSTEMS CHECK (00:15:00)	29:36:43	
IPTS, G&N, SCS, EPS, ECS		
START NAVIGATION (00:15:00)	30:31:44	
Navigational sighting (IMU on standby)		
Obtain present trajectory error & ephemeris miss-distance data		

<i>CSM</i>	<i>h:m:s</i>	<i>LEM</i>
<i>6.2.1 Coast to Second Midcourse Correction (cont)</i>		
SYSTEMS CHECK (00:20:00) IFTS, G&N, SCS, EPS, ECS Entry batteries, post-landing battery, & PLSS battery charge	30:46:44	
SYSTEMS CHECK (00:15:00) IFTS, G&N, SCS, EPS, ECS	31:36:43	
BEGIN SCS ATTITUDE ALIGNMENT (00:05:00) SCS attitude alignment	31:56:42	
LOSE GOSS COMMUNICATION (Madrid) START NAVIGATION (00:15:00) Navigational sighting (IMU on standby) Obtain present trajectory error & ephemeris miss-distance data	32:02:24 32:31:44	
SYSTEMS CHECK (00:25:00) IFTS, G&N, SCS, EPS, ECS, SPS, SM-RCS	32:46:44	
SYSTEMS CHECK (00:15:00) IFTS, G&N, SCS, EPS, ECS	33:36:43	
START NAVIGATION (00:23:00) Navigational sighting (IMU on standby) Obtain present trajectory error & ephemeris miss-distance data Obtain next delta-V correction parameter data SCS attitude alignment	34:31:44	

<i>CSM</i>	<i>h:m:s</i>	<i>LEM</i>
<i>6.2.1 Coast to Second Midcourse Correction (cont)</i>		
DOFF & DON PRESSURE SUITS (00:15:00)	34:45:00	
SYSTEMS CHECK (00:20:00)	34:54:43	
IFTS, G&N, SCS, EPS, ECS		
Entry batteries, post-landing battery, &		
PLSS battery charge		
CONTINUE SLEEP CYCLE (08:00:00)	35:00:00	
Astronaut No. 1 - active		
Astronaut No. 2 - rest		
Astronaut No. 3 - active		
ACQUIRE GOSS COMMUNICATION (Canberra)		
SYSTEMS CHECK (00:15:00)	35:02:24	
IFTS, G&N, SCS, EPS, ECS	35:36:43	
SYSTEMS CHECK (00:25:00)	36:36:43	
IFTS, G&N, SCS, EPS, ECS, SPS, SM-RCS		
START NAVIGATION (00:23:00)		
Navigational sighting (IMU on standby)		
Obtain present trajectory error & ephemeris miss-distance data		
Obtain next delta-V correction parameter data		
SCS attitude alignment		
LOSE GOSS COMMUNICATION (Austin)		
SYSTEMS CHECK (00:15:00)	38:47:24	
IFTS, G&N, SCS, EPS, ECS	38:54:43	

CSM	h:m:s	LEM
<i>6.2.1 Coast to Second Midcourse Correction (cont)</i>		
SYSTEMS CHECK (00:15:00) IFTS, G&N, SCS, EPS, ECS	39:36:43	
SYSTEMS CHECK (00:15:00) IFTS, G&N, SCS, EPS, ECS	40:36:43	
START CES OPERATIONS	40:41:42	
Prepare & ingest food		
SCS ATTITUDE ALIGNMENT (00:05:00)	41:26:42	
SYSTEMS CHECK (00:30:00) IFTS, G&N, SCS, EPS, ECS, SPS, SM-RCS, CM-RCS	41:36:43	
Fuel cell purge		
Entry batteries, post-landing battery, & PLSS battery charge	42:36:43	
SYSTEMS CHECK (00:15:00) IFTS, G&N, SCS, EPS, ECS	43:00:00	
DOFF & DON PRESSURE SUITS (00:15:00)	43:15:00	
CONTINUE REST CYCLE (7:45:00)		
Astronaut No. 1 - rest		
Astronaut No. 2 - active		
Astronaut No. 3 - active	43:36:43	
SYSTEMS CHECK (00:15:00) IFTS, G&N, SCS, EPS, ECS		

<i>CSM</i>	<i>h:m:s</i>	<i>LEM</i>
<i>6.2.1 Coast to Second Midcourse Correction (cont)</i>		
SECOND DELTA-V PREPARATION (00:35:00)	44:05:42	
IMU coarse alignment		
IMU fine alignment		
SCS attitude alignment		
IMU fine alignment check		
SCS, G&N, CES, SM-RCS		
SM-RCS ullage acceleration		
<i>6.2.2 Second Midcourse Correction</i>		
DELTA-V POWER PHASE (00:00:12)	44:40:48	
SPS firing		
<i>6.3 Coast thru Third Midcourse Correction</i>		
<i>6.3.1 Coast to Third Midcourse Correction</i>		
DELTA-V VERIFICATION (00:05:00)	44:40:59	
Confirm delta-V acquisition with GOSS		
SPS, SM-RCS securing after delta-V		
START SPACECRAFT SYSTEMS CHECK (00:30:00)	44:45:43	
IPTS, G&N, SCS, EPS, ECS, SPS, SM-RCS, CM-RCS		
Carbon dioxide & odor absorber cartridge replaced		
IMU TO STANDBY	44:47:23	

<i>CSM</i>	<i>h:m:s</i>	<i>LEM</i>
<i>6.3.1 Coast to Third Midcourse Correction (cont)</i>		
ACQUIRE GOSS COMMUNICATION (Madrid)	44:47:24	
START NAVIGATION (00:20:00)	45:02:35	
Navigational sighting (IMU on standby)		
Obtain present trajectory error & ephemeris miss-distance data		
SCS attitude alignment		
SYSTEMS CHECK (00:15:00)	45:37:37	
IFTS, G&N, SCS, EPS, ECS		
LOSE GOSS COMMUNICATION (Canberra)	46:32:24	
SYSTEMS CHECK (00:15:00)	46:37:37	
IFTS, G&N, SCS, EPS, ECS		
SYSTEMS CHECK (00:20:00)	47:37:37	
IFTS, G&N, SCS, EPS, ECS		
Entry batteries, post-landing battery, &		
PLSS battery charge		
START CES OPERATIONS	47:57:36	
Prepare & ingest food		
SCS ATTITUDE ALIGNMENT (00:05:00)	48:17:35	
SYSTEMS CHECK (00:25:00)	48:37:37	
IFTS, G&N, SCS, EPS, ECS, SPS, SM-RCS		
SYSTEMS CHECK (00:20:00)	49:37:37	
IFTS, G&N, SCS, EPS, ECS		
Fuel cell purge		
SYSTEMS CHECK (00:15:00)	50:37:37	
IFTS, G&N, SCS, EPS, ECS		

<i>CSM</i>	<i>h:m:s</i>	<i>LEM</i>
<i>6.3.1 Coast to Third Midcourse Correction (cont)</i>		
DOFF & DON PRESSURE SUITS (00:15:00)	51:00:00	
CONTINUE REST CYCLE (08:00:00)	51:15:00	
Astronaut No. 1 - active		
Astronaut No. 2 - active		
Astronaut No. 3 - rest		
START NAVIGATION (00:20:00)	51:02:35	
Navigational sighting (IMU on standby)		
Obtain present trajectory error & ephemeris miss-distance data		
SCS attitude alignment		
ACQUIRE GOSS COMMUNICATION (Austin)	51:32:24	
SYSTEMS CHECK (00:15:00)	51:37:37	
IFTS, G&N, SCS, EPS, ECS		
SYSTEMS CHECK (00:25:00)	52:37:37	
IFTS, G&N, SCS, EPS, ECS, SPS, SM-RCS		
SYSTEMS CHECK (00:20:00)	53:37:37	
IFTS, G&N, SCS, EPS, ECS		
Entry batteries, post-landing battery, &		
PLSS battery charge		
SYSTEMS CHECK (00:15:00)	54:37:37	
IFTS, G&N, SCS, EPS, ECS		
START NAVIGATION (00:20:00)	55:02:35	
Navigational sighting (IMU on standby)		
Obtain present trajectory error & ephemeris miss-distance data		

<i>CSM</i>	<i>h:m:s</i>	<i>LEM</i>
<i>6.3.1 Coast to Third Midcourse Correction (cont)</i>		
SCS attitude alignment		
SYSTEMS CHECK (00:15:00)	55:37:37	
IFTS, G&N, SCS, EPS, ECS		
START CES OPERATIONS	55:57:36	
Prepare & ingest food		
LOSE GOSS COMMUNICATION (Madrid)	56:17:24	
SYSTEMS CHECK (00:30:00)	56:37:37	
IFTS, G&N, SCS, EPS, ECS, SPS, SM-RCS, CM-RCS		
Carbon dioxide & odor absorber cartridge replaced		
SYSTEMS CHECK (00:20:00)	57:37:37	
IFTS, G&N, SCS, EPS, ECS		
Fuel cell purge		
SCS ATTITUDE ALIGNMENT (00:05:00)	58:17:35	
SYSTEMS CHECK (00:15:00)	58:37:37	
IFTS, G&N, SCS, EPS, ECS		
DOFF & DON PRESSURE SUITS (00:15:00)	59:15:00	
ACQUIRE GOSS COMMUNICATION (Canberra)	59:17:24	
CONTINUE REST CYCLE (02:45:00)	59:30:00	
Astronaut No. 1 - active		
Astronaut No. 2 - rest		
Astronaut No. 3 - active		

CSM	h.m.s	LEM
<i>6.3.1 Coast to Third Midcourse Correction (cont)</i>		
SYSTEMS CHECK (00:20:00) IFTS, G&N, SCS, EPS, ECS Entry batteries, post- landing battery, & PLSS battery charge	59:37:37	
SYSTEMS CHECK (00:25:00) IFTS, G&N, SCS, EPS, ECS, SPS, SM-RCS SCS ATTITUDE ALIGNMENT (00:05:00)	60:37:37	
SYSTEMS CHECK (00:15:00) IFTS, G&N, SCS, EPS, ECS DOFF & DON PRESSURE SUITS (00:15:00)	60:55:37 61:37:37	
CONTINUE REST CYCLE (02:45:00) Astronaut No. 1 - rest Astronaut No. 2 - active Astronaut No. 3 - active	62:15:00 62:30:00	
SYSTEMS CHECK (00:15:00) IFTS, G&N, SCS, EPS, ECS LOSE GOSS COMMUNICATION (Austin)	62:37:37	
START NAVIGATION (00:20:00) Navigational sighting (IMU on standby) Obtain present trajectory error & ephemeris miss-distance data SCS attitude alignment	63:02:24 63:02:35	
SYSTEMS CHECK (00:15:00) IFTS, G&N, SCS, EPS, ECS	63:37:37	

CSM	<i>h:m:s</i>	LEM
<i>6.3.1 Coast to Third Midcourse Correction (cont)</i>		
START CES OPERATIONS	63:57:36	
Prepare & ingest food		
SYSTEMS CHECK (00:30:00)	64:37:37	
IFTS, G&N, SCS, EPS, ECS, SPS, SM-RCS		
Fuel cell purge		
DOFF & DON PRESSURE SUITS (00:15:00)	65:15:00	
CONTINUE REST CYCLE (03:00:00)	65:30:00	
Astronaut No. 1 - active		
Astronaut No. 2 - active		
Astronaut No. 3 - rest		
SYSTEMS CHECK (00:20:00)	65:32:35	
IFTS, G&N, SCS, EPS, ECS		
Entry batteries, post- landing battery, &		
PLSS battery charge		
START NAVIGATION (00:23:00)	65:37:37	
Navigational sighting (IMU on standby)		
Obtain present trajectory error & ephemeris		
miss-distance data		
SCS attitude alignment		
Obtain next delta-V correction parameter		
data		
START NAVIGATION (00:18:00)	66:27:40	
Navigational sighting (IMU on standby)		
Obtain present trajectory error & ephemeris		
miss-distance data		

CSM	h:m:s	LEM
<i>6.3.1 Coast to Third Midcourse Correction (cont)</i>		
Obtain next delta-V correction parameter data		
SYSTEMS CHECK (00:15:00) IFTS, G&N, SCS, EPS, ECS	66:45:36	
START NAVIGATION (00:18:00)	67:04:12	
Navigational sighting (IMU on standby)		
Obtain present trajectory error & ephemeris miss-distance data		
Obtain next delta-V correction parameter data		
THIRD DELTA-V PREPARATION (00:35:00)	67:24:00	
IMU coarse alignment		
IMU fine alignment		
SCS attitude alignment		
IMU fine alignment check		
SCS, G&N, CES, SM-RCS		
SM-RCS ullage acceleration		
<i>6.3.2 Third Midcourse Correction</i>		
DELTA-V POWER PHASE (00:00:12)	67:59:46	
SPS firing		
<i>6.4 Preparation for Lunar Orbit Insertion</i>		
DELTA-V VERIFICATION (00:05:00)	67:59:58	
Confirm delta-V acquisition with GOSS		

<i>CSM</i>	<i>h:m:s</i>	<i>LEM</i>
<i>6.4 Preparation for Lunar Orbit Insertion (cont)</i>		
SPS, SM-RCS securing after delta-V START S/C SYSTEMS CHECK (00:30:00) IFTS, G&N, SCS, EPS, ECS, SM-RCS, CM-RCS	68:04:44	
Carbon dioxide & odor absorber cartridge replacement	68:17:35	
START NAVIGATION (00:18:00) Navigational sighting (IMU on operate) Obtain present trajectory error & ephemeris miss-distance data		
Obtain LOI parameter data Navigational sighting (IMU on operate) Obtain trajectory error & ephemeris miss-distance data		
Obtain LOI parameter data END REST CYCLE	68:30:00	
DON PRESSURE SUITS (00:15:00)	68:35:00	
START S/C PREPARATION FOR LOI (00:35:00)	68:42:53	
IMU fine alignment SCS attitude alignment		
IMU fine alignment check SCS, G&N, CES, & SM-RCS		
LOSE GOSS COMMUNICATION (Canberra)	69:04:12	

	<i>CSM</i>	<i>h:m:s</i>	<i>LEM</i>
<i>7.0 Lunar Orbit Insertion</i>			
PROPELLION SYSTEM IGNITION (00:05:23)		69:17:53	
Programmed injection maneuver monitoring			
SPS CUTOFF		69:23:16	
<i>8.0 Lunar Orbit Coast to LEM Separation</i>			
<i>8.1 Lunar Orbit Coast</i>			
CHECK ORBIT (00:15:00)		69:23:17	
Confirm lunar orbit acquisition			
Set controls			
Crew safety check			
Post-Delta-V EPS check			
ENTER SUNLIGHT			
START SYSTEMS CHECK (00:30:00)			
IFTS, G&N, EPS, ECS, SCS, SPS, SM-RCS, CM-RCS			
S/C-GOSS communications set up			
CES operations			
ACQUIRE GOSS COMMUNICATION (Madrid, Canberra)		69:43:12	
START NAVIGATION (00:24:00)			
Orbital landmark navigational sighting No. 1			
Obtain present trajectory error & ephemeris miss-distance data		69:56:00	

<i>CSM</i>	<i>h:m:s</i>	<i>LEM</i>
<i>8.1 Lunar Orbit Coast (cont)</i>		
Orbital landmark navigational sighting No. 2 Obtain present trajectory error & ephemeris miss-distance data		
APPEAR ABOVE LANDING SITE HORIZON START NAVIGATION SIGHTING (00:12:00)	70:13:12 70:20:41	
Orbital landmark navigational sighting No. 3 PASS OVER LANDING SITE Obtain present trajectory error & ephemeris miss-distance data	70:21:00	
LOSE GOSS COMMUNICATION (Canberra) START NAVIGATION SIGHTING (00:12:00)	70:25:00 70:33:00	
Orbital navigation sighting No. 4 DISAPPEAR BELOW LANDING SITE HORIZON Obtain present trajectory error & ephemeris miss-distance data	70:38:10	
LEAVE SUNLIGHT INTERLOCK PRESSURIZATION (00:02:00)	70:46:44 70:50:05	
Interlock pressurization operation (00:01:00) Interlock leak check operation (00:01:00)	70:50:05 70:51:05	
REMOVE & STOW DOCKING MECHANISM (00:10:00)	70:52:05	
Open CM hatch Removal & stowage of CSM probe in CM (00:05:00)	70:52:05	

CSM	<i>h:m:s</i>	LEM
<i>8.1 Lunar Orbit Coast (cont)</i>		
Removal & stowage of LEM drogue in CM (00:05:00)		
LOSE GOSS COMMUNICATION (Madrid)		
	70:58:48	LEM CABIN PRESSURIZATION (00:05:00)
	71:02:05	Pressurize cabin (00:03:00) Leak check cabin (00:02:00)
	71:07:05	TRANSFER SYSTEMS ENGINEER & COMMANDER TO LEM (00:05:00) Open LEM hatch (00:01:00) Activate cabin lighting (00:00:30) Activate caution & warning system (00:00:30) Transfer crew to LEM cabin (00:03:00)
<i>8.2 Preparation for LEM Separation</i>		
	71:12:05	ESTABLISH LEM CABIN HABITABILITY CONDITIONS (00:03:15)
		Check status of caution & warning system (00:00:30)
		Visually inspect cabin interior (00:01:00) Activate panel displays (00:01:00)
		Perform initial check of ECS & bring to standby operation (00:00:15)
		Connect suit umbilical to ECS (00:00:15)
		Establish hard-line voice link with CSM (00:00:15)

<i>CSM</i>	<i>h:m:s</i>	<i>LEM</i>
<i>8.2 Preparation for LEM Separation (cont)</i>		
	71:15:20	START PRESEPARATION LEM SYSTEMS CHECKOUT (00:36:45)
		Power generation
		Power distribution
		ECS checkout & fill both PLSS units with water
Close CM hatch, leave valve open to main- tain LEM cabin pressure		Close LEM hatch leaving cabin relief & dump valve open
		Deploy landing gear*
		VHF communication
		Initialize LGC with CSM ephemeris
		Activate IMU
		Coarse align IMU with LGC
		Fine align IMU with LGC
		Align BUGS
		Crosscheck PNCS & BUGS
		FC, SCS
	71:21:17	BEGIN IMU ALIGNMENT (00:12:00)
		IMU fine alignment for navigation sighting
		SCS attitude alignment
		IMU fine alignment check
	71:32:00	OPEN CM HATCH (00:01:00)
	71:33:32	ENTER SUNLIGHT
	71:34:00	TRANSFER EQUIPMENT TO LEM (00:01:00)
RECEIVE EQUIPMENT FROM CSM (00:01:00)		

* Performed during translunar checkout

<i>CSM</i>	<i>h:m:s</i>	<i>LEM</i>
<i>8.2 Preparation for LEM Separation (cont)</i>		
REINSTALL DOCKING MECHANISM (00:10:00)	71:35:00	REINSTALL DOCKING MECHANISM IN UPPER LEM HATCH (00:10:00)
CLOSE CSM HATCH, LEAVE VALVE OPEN TO MAINTAIN LEM CABIN PRESSURE	71:45:00	CLOSE LEM HATCH & LEAVE CABIN RELIEF & DUMP VALVE OPEN
ACQUIRE GOSS COMMUNICATION (Madrid)	71:45:36	ACQUIRE GOSS COMMUNICATIONS
		S-BAND COMMUNICATION SYSTEM CHECK- OUT (00:10:00)
		Deploy S-band steerable antenna*
		Align S-band steerable antenna
		Checkout S-band system
	71:56:05	COMPLETE PRESEPARATION LEM SYSTEMS CHECKOUT (00:21:00)
		Ascent propulsion
		Descent propulsion
		RCS
BEGIN NAVIGATION SIGHTING (00:24:00)	71:59:00	
Orbital landmark navigational sighting No. 5		
Obtain present trajectory error & ephemeris miss-distance data		
Orbital landmark navigational sighting No. 6		
Obtain present trajectory error & ephemeris miss-distance data		
Obtain TEI parameter data		
APPEAR ABOVE LANDING SITE HORIZON	72:14:26	

* Performed during translunar checkout

CSM	<i>h:m:s</i>	LEM
<i>8.2 Preparation for LEM Separation (cont)</i>		
	72:17:05	PRESSURIZE DESCENT PROPULSION SYSTEM (00:01:00)
		Fire pressurization squib valves
		Checkout descent propulsion system
	72:18:05	PRESSURIZE RCS (00:01:00)
		Vent RCS manifold (00:00:20)
	72:18:25	Fire pressurization squib valves (00:00:20)
		Checkout RCS (00:00:20)
	72:18:45	PREPARE FOR CSM/LEM SEPARATION (00:29:00)
		Fine align IMU utilizing LGC (00:15:00)
	72:19:05	PASS OVER LANDING SITE
	72:21:55	BEGIN CM SYSTEMS CHECK (00:09:00)
	72:28:00	IFTS, EPS, ECS
	72:29:34	DISAPPEAR BELOW LANDING SITE HORIZON
	72:34:05	Align BUGS (00:02:00)
	72:36:05	Determine Hohmann transfer parameters from LGC (00:01:00)
	72:37:05	Open LEM hatch (00:01:00)
	72:38:05	Release hard-dock latches (00:03:00)
	72:41:05	Disconnect umbilical (00:00:15)
	72:41:20	Close LEM hatch (00:00:45)
	72:42:05	Activate rendezvous radar & transponder (00:00:10)

<i>CSM</i>	<i>h:m:s</i>	<i>LEM</i>
<i>8.2 Preparation for LEM Separation (cont)</i>		
CLOSE CSM HATCH VALVE	72:42:15	Activate O ₂ supply & pressurization system & checkout (00:02:00)
	72:44:15	Close cabin relief & dump valve in upper hatch (00:01:00)
	72:45:15	Secure crew & equipment (00:02:00)
	72:47:15	Select direct mode for separation (00:00:20)
	72:47:35	Begin countdown for separation (00:00:30)
<i>9.0 CSM Lunar Orbit Operations</i>		<i>10.0 LEM Descent</i>
<i>9.1 LEM/CSM Separation</i>		<i>10.1 LEM/CSM Separation & Preparation for Descent</i>
		<i>10.1.1 LEM/CSM Separation</i>
INITIATE RELEASE OF SOFT DOCK MECHANISM	72:48:04	
MONITOR LEM SEPARATION		LEM/CSM SEPARATION (00:00:05)
	72:48:05	Manually fire RCS to translate (00:00:05)
	72:48:10	LEM FLYAWAY FROM CSM (00:01:13)
	72:48:10	Select attitude hold mode (00:00:05)
	72:48:10	Manually control separation to 500 ft (00:01:13)
LEAVE SUNLIGHT	72:48:14	LEAVE SUNLIGHT

<i>CSM</i>	<i>h:m:s</i>	<i>LEM</i>
<i>9.1 LEM/CSM Separation (cont)</i>		<i>10.1.2 Preparation For Descent</i>
		<p>CHECKOUT RENDEZVOUS RADAR (00:15:00) Lock rendezvous radar to LEM Checkout rendezvous radar</p> <p>LOSE GOSS COMMUNICATION (Madrid)</p> <p>CHECKOUT RENDEZVOUS RADAR (00:04:00) Lock rendezvous radar to CSM (00:02:00) Checkout rendezvous radar (00:02:00)</p> <p>ALIGN GUIDANCE SYSTEM (00:18:00) Course align IMU with LGC (00:01:00) Fine align IMU with AOT (00:15:00)</p> <p>LOSE GOSS COMMUNICATION (Madrid) Align BUGS (00:02:00)</p> <p>CHECKOUT LANDING RADAR (00:04:00) Activate landing radar (00:02:00) Skin track CSM (00:02:00)</p> <p>PREPARE FOR HOHMANN TRANSFER INSERTION (00:02:35)</p> <p>Select automatic guidance mode (00:00:20) Automatic orientation of vehicle for insertion (00:00:35)</p> <p>Arm descent engine (00:00:10) Determine Hohmann transfer insertion parameters (00:01:00)</p> <p>Begin countdown to insertion (00:00:30) RCS ULLAGE IGNITION INITIATED (00:01:00)</p>

<i>CSM</i>	<i>h:m:s</i>	<i>LEM</i>
<i>9.2 Lunar Orbit Coast (to Phase 13.0)</i>		<i>10.2 Transfer Orbit Insertion</i>
MONITOR LEM HOHMANN TRANSFER ORBIT INSERTION		BEGIN DESCENT ENGINE IGNITION (00:00:07) Commanded insertion maneuver initiated & monitored
	73:18:04	DESCENT ENGINE SHUTDOWN Commanded cutoff initiated & monitored
	73:18:11	<i>10.3 Coast to Powered Descent Initiation</i>
		DISARM DESCENT ENGINE (00:00:10) CONFIRM HOHMANN TRANSFER DESCENT ORBIT PARAMETERS (00:03:10) Select attitude hold mode (00:00:10) Manually orient vehicle for radar tracking (00:00:20) Lock rendezvous radar to CSM (00:00:30) Check mutual tracking parameters (00:01:00)
		Check mutual tracking parameters (00:01:00) LEM orbit descent parameters determined & communicated to LEM (00:01:00) Maintain CSM radar track of LEM ENTER SUNLIGHT
		73:20:23 73:21:23 73:34:59 73:36:00 ENTER SUNLIGHT

<i>CSM</i>	<i>h:m:s</i>	<i>LEM</i>
<i>9.2 Lunar Orbit Coast (to Phase 13.0) (cont)</i>		<i>10.3 Coast to Powered Descent Initiation (cont)</i>
	73:46:08	ALIGN GUIDANCE SYSTEMS (00:17:00)
ACQUIRE GOSS COMMUNICATION (Madrid)	73:46:08	Fine align IMU with AOT (00:15:00)
BEGIN CSM SYSTEMS CHECK (00:10:00)	73:47:24	
IPTS, EPS, ECS	73:50:00	
	74:01:08	ALIGN BUGS (00:02:00)
	74:10:00	LANDING RADAR SELF CHECK AT 70, 000 FT
	74:13:56	PREPARATION FOR POWERED DESCENT (00:02:10)
	74:13:56	Select automatic guidance mode (00:00:10)
	74:14:06	Automatic orient of vehicle for insertion (00:00:20)
	74:14:26	Arm descent engine (00:00:10)
	74:14:36	Determine powered descent trajectory parameters (00:01:00)
	74:15:36	Establish throttle position (00:00:10)
	74:15:36	Deactivate rendezvous radar (00:00:10)
	74:15:46	Begin countdown for powered descent (00:00:30)
APPEAR ABOVE LANDING SITE HORIZON	74:15:40	
	74:16:07	RCS ULLAGE IGNITION INITIATED (00:00:01)

CSM	<i>h:m:s</i>	LEM
<i>9.2 Lunar Orbit Coast (to Phase 13.0) (cont)</i>		<i>10.4 Powered Descent to Hover</i>
MONITOR LEM INITIAL POWERED DESCENT (00:05:50)		BEGIN DESCENT ENGINE IGNITION FOR INITIAL POWERED DESCENT (00:05:50) Commanded insertion maneuvers initiated & monitored Constant thrust, constant attitude phase monitored
	74:16:08	Landing radar altitude data operative at 20,000 ft, & coordinated with CSM & GOSS BEGIN TERMINAL DESCENT PHASE (00:01:54)
Confirm status of LEM landing radar	74:21:51	Commanded orientation of vehicle for landing
MONITOR LEM TERMINAL DESCENT PHASE (00:01:54)	74:21:58	site evaluation Landing radar velocity data operative at 11,000 ft & coordinated with CSM & GOSS Commence updating of LGC altitude & altitude rate data
Confirm status of LEM landing radar	74:23:00	Visual & instrument verification of prehover parameters
	74:23:00	
		<i>10.5 Hover to Touchdown</i>
CONFIRM START OF LEM HOVER	74:23:52	PREPARATION FOR LANDING (00:00:15)
	74:23:52	Select hover to landing modes (00:00:05)
	74:23:57	Vehicle pitchover to hover orientation (00:00:10)

<i>CSM</i>	<i>h:m:s</i>	<i>LEM</i>
<i>9.2 Lunar Orbit Coast (to Phase 13.0) (cont)</i>		<i>10.5 Hover to Touchdown (cont)</i>
Confirm LEM landing radar repositioning		Verify landing radar repositioned by LGC (00:00:05)
	74:24:02	Deploy landing aids (00:00:05)
	74:24:07	CONTROLLED LANDING (00:01:44)
	74:24:07	Vehicle descent rate controlled & monitored
		Vehicle translation rate controlled & monitored
		Vehicle attitude controlled & monitored
		TOUCHDOWN ON LUNAR SURFACE (00:00:01)
	74:25:51	Shutdown of descent engine at 5-ft altitude
	74:25:51	Landing gear contact with lunar surface
	74:25:52	
CONFIRM LEM TOUCHDOWN & DETERMINE LANDING SITE COORDINATES		
		<i>11.0 LEM Lunar Stay</i>
		<i>11.1 Post-Landing Checkout</i>
	74:25:52	DISARM DESCENT ENGINE (00:00:10)
	74:26:02	ESTABLISH EMERGENCY ASCENT CONDITIONS (00:02:00)
	74:26:02	Confirm landing with CSM & GOSS (00:00:20)
	74:26:22	Check caution & warning system (00:00:10)
	74:26:32	Check vehicle stability (00:00:10)
	74:26:42	Select ascent mode (00:00:10)
	74:26:52	Determine landing site location from CSM (00:01:00)

<i>CSM</i>	<i>h:m:s</i>	<i>LEM</i>
<i>9.2 Lunar Orbit Coast (to Phase 13.0) (cont)</i>		<i>11.1 Post-Landing Checkout (cont)</i>
	74:27:02	START POST- LANDING SYSTEMS CHECKOUT (00:25:10)
		RCS
		Ascent propulsion
		EPS, G&N, SCS, FC
		Record final descent propulsion parameters
DISAPPEAR BELOW LANDING SITE HORIZON	74:30:38	LOS BLACKOUT WITH CSM
Deactivate VHF (00:00:10)	74:30:38	Deactivate VHF (00:00:10)
Deactivate rendezvous radar (00:00:10)	74:30:48	Deactivate rendezvous radar transponder (00:00:10)
LEAVE SUNLIGHT	74:49:41	
BEGIN CSM SYSTEMS CHECK (00:40:00)	74:50:00	
IFTS, G&N, SCS, EPS, ECS, SPS, SM-RCS, CM-RCS		
	74:53:02	CHECKOUT PLSS (00:06:00)
LOSE GOSS COMMUNICATION (Madrid)	75:03:00	
Activate tape recorder		
	75:03:02	DETERMINE FEASIBILITY OF CONDUCTING LUNAR SURFACE OPERATIONS (00:10:00)
	75:03:02	Evaluate crew physiological condition & coordinate with GOSS (00:01:00)
	75:04:02	Evaluate lunar surface conditions & coordinate with GOSS (00:04:00)
	75:08:02	Review & perform scheduled inspection & adjustments, & coordinate with GOSS (00:05:00)

<i>CSM</i>	<i>h:m:s</i>	<i>LEM</i>
<i>9.2 Lunar Orbit Coast (to Phase 13, 0) (cont.)</i>		<i>11.1 Post-Landing Checkout (cont)</i>
	75:13:02	DEACTIVATE SYSTEMS (00:00:40) Disarm RCS (00:00:10) Place IMU & LGC to standby mode (00:00:10) Deactivate SCS (00:00:10) Deactivate FC (00:00:10) PREPARATION OF EQUIPMENT FOR EGRESS TO LUNAR SURFACE (00:27:00)
	75:13:52	Review scientific activities & coordinate with GOSS (00:02:00) Prepare lunar surface equipment (00:05:00) Don PLSS (00:08:30) Check PLSS- ARS- suit pressure integrity (00:02:50)
	75:15:52	Don personal equipment (00:08:30)
	75:20:52	75:29:22
	75:32:12	ENTER SUNLIGHT
	75:36:29	Crew transfer to closed-suit operation (00:00:10)
	75:40:42	<i>11.2 Lunar Exploration</i>
	75:40:52	PREPARE TO EGRESS TO LUNAR SURFACE (00:02:20) C-Dump LEM cabin pressure (00:01:00)
	75:40:52	C-Open LEM hatch (00:01:00)
	75:41:52	C-Erect boarding platform (00:00:20)
	75:42:52	C-DESCEND TO LUNAR SURFACE (00:02:00)
	75:43:12	

<i>CSM</i>	<i>h:m:s</i>	<i>LEM</i>
<i>9.2 Lunar Orbit Coast (to Phase 13.0) (cont)</i>		<i>11.2 Lunar Exploration (cont)</i>
ACQUIRE GOSS COMMUNICATION (Madrid)	75:45:12	C-TEST BODY MOBILITY (00:05:00)
Deactivate tape recorder	75:49:12	
Enable S-band operation		
ACQUIRE GOSS COMMUNICATION (Austin)	75:49:48	C-PERFORM SCHEDULED INSPECTIONS & ADJUSTMENTS (00:15:00)
BEGIN CES OPERATIONS (00:15:00)	75:55:00	
Prepare & ingest food		
	76:05:12	C/S-UNLOAD LUNAR EQUIPMENT
	76:15:12	S-ESTABLISH CONDITIONS WITHIN S/C (00:01:30)
	76:15:12	S-Close LEM hatch (00:01:00)
	76:16:12	S-Begin SOX pressurization of cabin (00:00:20)
	76:16:32	S-Distribute power for lunar surface equipment (00:00:10)
	76:16:42	C-ERECT & ALIGN LUNAR SURFACE ANTENNAS (00:15:00)
	76:16:44	S-COORDINATE WITH CSM (00:15:18)
COORDINATE WITH LEM (00:15:28)	76:16:44	S-Activate rendezvous radar transponder (00:00:10)
Activate rendezvous radar (00:00:10)		
Appear above landing site horizon	76:16:54	S-LOS establishment with CSM & coordination
Track LEM with radar	76:16:54	
Pass over landing site & record LEM data	76:24:33	

<i>CSM</i>	<i>h:m:s</i>	<i>LEM</i>
<i>9.2 Lunar Orbit Coast (to Phase 13.0) (cont)</i>		<i>11-2 Lunar Exploration (cont)</i>
Disappear below landing site horizon Deactivate VHF & rendezvous radar (00:00:20)	76:31:42	C-PREPARE SCIENTIFIC EQUIPMENT (00:10:00)
BEGIN CSM SYSTEMS CHECK (00:25:00) IFTS, G&N, SCS, EPS, ECS	76:31:52 76:32:02	S- LOS blackout with CSM S- Deactivate rendezvous radar transponder (00:00:10)
LEAVE SUNLIGHT	76:36:00	C-BEGIN CAMERA COVERAGE & SCIENTIFIC ACTIVITIES (01:36:18)
LOSE GOSS COMMUNICATION (Austin) LOSE GOSS COMMUNICATION (Madrid)	76:41:42	
Activate tape recorder	76:51:11	
BEGIN CSM SYSTEMS CHECK (00:25:00) IFTS, G&N, SCS, EPS, ECS	77:04:12 77:05:24 77:15:00	
ENTER SUNLIGHT	77:16:12	S-COMPLETE SOX PRESSURIZATION OF CABIN Open face plate
BEGIN IMU ALIGNMENT (00:12:00) IMU fine alignment SCS attitude alignment IMU fine alignment check	77:18:12 77:37:59 77:39:00	S-REPLACE LIOH CANISTER (00:02:00)

<i>CSM</i>	<i>h:m:s</i>	<i>LEM</i>
<i>9.2 Lunar Orbit Coast (to Phase 13.0) (cont)</i>		<i>11.2 Lunar Exploration (cont)</i>
ACQUIRE GOSS COMMUNICATION (Austin) Deactivate tape recorder Enable S-band operation	77:51:00	
ACQUIRE GOSS COMMUNICATION (Madrid) START NAVIGATION (00:12:00)	77:52:12	
Perform landmark navigation sighting Orbit ephemeris determination	78:06:00	
	78:18:00	C-PREPARE EQUIPMENT FOR RETURN TO LEM (00:10:00)
COORDINATE WITH LEM (00:15:18) Appear above landing site horizon Activate VHF and coordinate	78:18:08	S-COORDINATE WITH CSM (00:14:58) S-LOS establishment with CSM & coordination
Pass over landing site & record LEM data Disappear below landing site horizon Deactivate VHF (00:00:10)	78:25:37	
START NAVIGATION (00:12:00)	78:33:06	S-LOS blackout with CSM
Perform landmark navigation sighting Orbit ephemeris determination	78:33:06	
	78:35:16	S-PREPARE FOR EGRESS TO LUNAR SURFACE (00:02:10)
	78:35:16	S-Deactivate ground power & close face plate (00:00:10)
	78:35:26	S-Dump LEM cabin pressure (00:01:00)
	78:36:26	S-Open LEM hatch (00:01:00)

<i>CSM</i>	<i>h:m:s</i>	<i>LEM</i>
<i>9.2 Lunar Orbit Coast (to Phase 13.0) (cont)</i>		<i>11.2 Lunar Exploration (cont)</i>
BEGIN CSM SYSTEMS CHECK (00:30:00) IFTS, G&N, SCS, EPS, ECS, SPS, SM-RCS	78:37:36 78:45:30	C/S LOAD EQUIPMENT (00:10:00)
	78:47:26 78:47:26 78:49:26 78:49:36	C-INGREES TO LEM (00:02:10) C-Ascent into cabin (00:02:00) C-Connects to ECS (00:00:10) C-INITIATE NO. 1 PLSS REPLENISHMENT (00:03:00)
LEAVE SUNLIGHT	78:52:36 78:52:41 78:54:36 78:59:36 79:04:36 79:04:36 79:05:36 79:05:56 79:06:06	S-DESCEND TO LUNAR SURFACE (00:02:00) S-TEST BODY MOBILITY (00:05:00) S-PERFORM SCHEDULED INSPECTIONS & ADJUSTMENTS (00:05:00) C-ESTABLISH CONDITIONS WITHIN S/C (00:01:30) C-Close LEM hatch (00:01:00) C-Begin SOX pressurization of cabin (00:00:20) C-Distribute power for lunar surface equip- ment (00:00:10) S-REALIGN LUNAR SURFACE ANTENNAS (00:05:00)
LOSE GOSS COMMUNICATION (Austin & Madrid) Activate tape recorder	79:07:12 79:11:06	S-PREPARE SCIENTIFIC EQUIPMENT (00:05:00)

<i>CSM</i>	<i>h:m:s</i>	<i>LEM</i>
<i>9.2 Lunar Orbit Coast (to Phase 13.0) (cont)</i>		<i>11.2 Lunar Exploration (cont)</i>
BEGIN SYSTEMS CHECK (00:35:00)		S-BEGIN CAMERA COVERAGE & SCIENTIFIC ACTIVITIES (02:12:20)
IFTs, G&N, SCS, EPS, ECS		
Replace CO ₂ Cartridge		
ENTER SUNLIGHT	79:39:29	
ACQUIRE GOSS COMMUNICATION (Austin & Madrid)	79:54:36	
Enable S-band operation		C-COMPLETE SOX PRESSURIZATION OF CABIN
		Open face plate
START NAVIGATION (00:24:00)	80:09:36	
Perform landmark navigation sighting		
Orbit ephemeris determination		
Perform landmark navigation sighting		
Orbit ephemeris determination		
COORDINATE WITH LEM (00:15:18)	80:19:22	C-COORDINATE WITH CSM (00:14:58)
Appear over landing site	80:19:22	C-LOS establishment with CSM & coordination
Activate VHF & coordinate		
Pass over landing site & record LEM data	80:26:51	
LOSE GOSS COMMUNICATION (Madrid)	80:29:24	

<i>CSM</i>	<i>h:m:s</i>	<i>LEM</i>
<i>9.2 Lunar Orbit Coast (to Phase 13.0) (cont)</i>		<i>11.2 Lunar Exploration (cont)</i>
START NAVIGATION (00:24:00)	80:34:00	
Perform landmark navigation sighting		
Orbit ephemeris determination		
Perform landmark navigation sighting		
Orbit ephemeris determination		
Disappear below landing site horizon	80:34:20	C- LOS blackout with CSM
Deactivate VHF (00:00:10)	80:54:11	
LEAVE SUNLIGHT	80:58:00	
BEGIN CSM SYSTEMS CHECK (00:10:00)		
IPTS, EPS, ECS		
LOSE GOSS COMMUNICATION (Austin)	81:09:00	
Activate tape recorder		
BEGIN REST CYCLE (08:00:00)	81:13:00	
	81:28:26	S-PREPARE EQUIPMENT FOR RETURN TO LEM (00:10:00)
	81:38:26	C-PREPARE FOR RETURN OF SYSTEMS ENGINEER (00:12:10)
	81:38:26	C- Deactivate ground power & close face plate (00:00:10)
	81:38:36	C- Dump LEM cabin pressure (00:01:00)
	81:39:36	C- Open LEM hatch (00:01:00)
	81:40:36	C/S- Load equipment (00:10:00)
ENTER SUNLIGHT	81:40:59	

CSM	h:m:s	LEM
<i>9.2 Lunar Orbit Coast (to Phase 13.0) (cont)</i>		<i>11.2 Lunar Exploration (cont)</i>
		S-INGRESS TO LEM (00:02:10)
81:50:36		S- Ascend into cabin (00:02:00)
81:52:36		S- Connects to ECS (00:00:10)
81:52:46		C-ESTABLISH CONDITIONS WITHIN S/C (00:02:10)
81:52:46		C-Close LEM hatch (00:01:00)
81:53:46		C-Begin GOX pressurization of cabin (00:01:00)
81:54:46		C/S-Complete GOX pressurization of cabin & open face plates
81:54:46		C-Deactive VHF (00:00:10)
81:55:06		C/S-REMOVE & STOW EQUIPMENT (00:10:00)
81:55:12		ACQUIRE GOSS COMMUNICATION (Austin)
82:05:06		C/S-REVIEW & RECORD LUNAR ACTIVITIES (00:10:00)
82:15:06		S-BEGIN OFF-DUTY ACTIVITIES (04:00:00) Eat, sleep/rest
82:15:06		C-BEGIN ON-BOARD SCIENTIFIC ACTIVITIES
82:20:26		C-COORDINATE WITH CSM (00:15:18)
82:20:26		C-Activate VHF (00:00:10)
82:20:36		C-LOS establishment with CSM & coordination if CSM crew member awake
82:28:05		Pass over landing site
82:35:34		Disappear below landing site horizon
		C- LOS blackout with CSM

<i>CSM</i>	<i>h:m:s</i>	<i>LEM</i>
<i>9.2 Lunar Orbit Coast (to Phase 13.0) (cont)</i>		<i>11.2 Lunar Exploration (cont)</i>
LEAVE SUNLIGHT	82:35:34	C- Deactivate VHF (00:00:10)
LOSE GOSS COMMUNICATION (Austin)		
	82:55:41	
	83:10:48	C-COMPLETE NO. 1 PLSS REPLENISHMENT (00:03:00)
	83:19:36	C-INITIATE NO. 2 PLSS REPLENISHMENT (00:03:00)
	83:22:36	C-REPLACE LIOH CANISTER (00:02:00)
ENTER SUNLIGHT	83:25:36	
ACQUIRE GOSS COMMUNICATION (Austin & Canberra)	83:42:29	
	83:57:36	
	84:21:40	C-COORDINATE WITH CSM (00:15:18)
	84:21:40	C-Activate VHF (00:00:10)
	84:21:50	C-LOS establishment with CSM & coordination if CSM crew member awake
	84:29:19	
	84:36:48	C- LOS blackout with CSM
	84:36:48	C- Deactivate VHF (00:00:10)
LEAVE SUNLIGHT	84:57:11	.
LOSE GOSS COMMUNICATION (Canberra)	85:13:12	
LOSE GOSS COMMUNICATION (Austin)	85:13:48	
ENTER SUNLIGHT	85:43:41	
ACQUIRE GOSS COMMUNICATION (Austin & Canberra)	85:59:24	

<i>CSM</i>	<i>h:m:s</i>	<i>LEM</i>
<i>9.2 Lunar Orbit Coast (to Phase 13.0) (cont)</i>		<i>11.2 Lunar Exploration (cont)</i>
	86:15:06	C/S-SWITCH DUTY STATIONS (00:05:00)
	86:20:06	C-BEGIN OFF-DUTY ACTIVITIES (04:00:00) Eat, sleep/rest
	86:20:06	S-BEGIN ON BOARD SCIENTIFIC ACTIVITIES
	86:22:54	S-COORDINATE WITH CSM (00:15:18)
	86:22:54	S-Activate VHF (00:00:10)
	86:23:04	S-LOS establishment with CSM 7 coordination if CSM crew member awake
	86:30:33	
	86:38:02	S-LOS blackout with CSM
	86:38:02	S-Deactivate VHF (00:00:10)
	86:58:41	
	87:15:36	
	87:45:29	
	87:55:36	S-COMPLETE NO. 2 PLSS REPLENISHMENT (00:03:00)
	88:01:12	
	88:24:08	S-COORDINATE WITH CSM (00:15:18)
	88:24:08	S-Activate VHF (00:00:10)
	88:24:18	S-LOS establishment with CSM & coordination if CSM crew member awake
	88:31:47	
	88:39:16	S-LOS blackout with CSM
	88:39:16	S-Deactivate VHF (00:00:10)

<i>CSM</i>	<i>h:m:s</i>	<i>LEM</i>
<i>9.2 Lunar Orbit Coast (to Phase 13.0) (cont)</i>		<i>11.2 Lunar Exploration (cont)</i>
LEAVE SUNLIGHT		
END REST CYCLE	89:00:11	S- REPLACE LIOH CANISTER (00:02:00)
LOSE GOSS COMMUNICATION (Canberra)	89:12:05	
Activate tape recorder	89:13:00	
BEGIN CSM SYSTEMS CHECK (00:40:00)	89:16:12	
IPTS, G&N, SCS, EPS, ECS, SPS, SM-RCS, CM-RCS	89:40:00	
ENTER SUNLIGHT	89:46:59	
ACQUIRE GOSS COMMUNICATION (Canberra)	90:03:36	
Enable S-band operation		
COORDINATE WITH LEM (00:15:18)	90:25:22	S- COORDINATE WITH CSM (00:15:18)
Activate VHF (00:00:10)	90:25:22	S- Activate VHF (00:00:10)
Appear above landing site horizon	90:25:32	S- LOS establishment with CSM & coordination
Pass over landing site & record LEM data	90:33:01	
Disappear below landing site horizon	90:40:30	S- LOS blackout with CSM
Deactivate VHF (00:00:10)	90:40:30	S- Deactivate VHF (00:00:10)
	90:40:40	C/S- PREPARE EQUIPMENT FOR EGRESS TO LUNAR SURFACE (00:26:00)
	90:40:40	C/S- Review scientific activities & coordinate with GOSS (00:02:00)
BEGIN CSM SYSTEMS CHECK (00:35:00)	90:41:00	
IPTS, G&N, SCS, EPS, ECS		

<i>CSM</i>	<i>h:m:s</i>	<i>LEM</i>
<i>9.2 Lunar Orbit Coast (to Phase 13.0) (cont)</i>		<i>11.2 Lunar Exploration (cont)</i>
Replace CO ₂ cartridge		
	90:42:40	C/S-Prepare lunar surface equipment (00:05:00)
	90:47:40	C/S-Don PLSS (00:08:30)
	90:56:10	C/S-Check PLSS-ARS- suit pressure integrity (00:02:50)
	90:59:00	C/S-Don personal equipment (00:07:20)
LEAVE SUNLIGHT		
	91:01:41	
	91:06:20	C/S-Crew transfer to closed-suit operation (00:00:10)
	91:06:30	C/S-Activate VHF (00:00:10)
	91:07:08	C-EGRESS TO LUNAR SURFACE (00:02:00)
	91:07:08	C-Dump LEM cabin pressure (00:01:00)
	91:08:08	C-Open LEM hatch (00:01:00)
	91:09:08	C-DESCEND TO LUNAR SURFACE (00:02:00)
	91:11:08	C-TEST BODY MOBILITY (00:05:00)
	91:16:08	C-PERFORM SCHEDULED INSPECTIONS & ADJUSTMENTS (00:10:00)
LOSE GOSS COMMUNICATION (Canberra)		
Activate tape recorder		
	91:26:08	C/S-UNLOAD LUNAR EQUIPMENT (00:10:00)
	91:36:08	S-ESTABLISH CONDITIONS WITHIN S/C (00:01:30)
	91:36:08	S-Close LEM hatch (00:01:00)

<i>CSM</i>	<i>h:m:s</i>	<i>LEM</i>
<i>9.2 Lunar Orbit Coast (to Phase 13.0) (cont)</i>		<i>11.2 Lunar Exploration (cont)</i>
		<p>91:37:08 S-Begin SOX pressurization of cabin (00:00:20)</p> <p>91:37:28 S-Distribute power for lunar surface equipment (00:00:10)</p> <p>91:37:38 C-REALIGN LUNAR SURFACE ANTENNAS (00:05:00)</p> <p>91:42:38 C-PREPARE SCIENTIFIC EQUIPMENT (00:05:00)</p> <p>91:47:38 C-BEGIN CAMERA COVERAGE & SCIENTIFIC ACTIVITIES (01:57:20)</p> <p>91:48:29 ENTER SUNLIGHT</p> <p>92:05:24 ACQUIRE GOSS COMMUNICATION (Canberra)</p> <p>92:26:46 COORDINATE WITH LEM (00:15:18)</p> <p>Activate VHF</p> <p>Appear above landing site horizon</p> <p>BEGIN IMU ALIGNMENT (00:12:00)</p> <p>Activate S-band operations</p> <p>IMU fine alignment</p> <p>SCS attitude alignment</p> <p>IMU fine alignment check</p> <p>Pass over landing site & record LEM data</p> <p>92:34:15 Disappear below landing site horizon</p> <p>92:37:08 Deactivate VHF (00:00:10)</p> <p>S-Complete SOX pressurization of cabin & open face plate</p> <p>S-LOS blackout with CSM</p>

<i>CSM</i>	<i>h:m:s</i>	<i>LEM</i>
<i>9.2 Lunar Orbit Coast (to Phase 13.0) (cont)</i>		<i>11.2 Lunar Exploration (cont)</i>
START NAVIGATION (00:24:00)	92:45:00	
Perform landmark navigation sighting		
Orbit ephemeris determination		
Perform landmark navigation sighting		
Orbit ephemeris determination		
LEAVE SUNLIGHT	93:03:11	
BEGIN CES OPERATIONS (00:15:00)	93:10:00	
Prepare & ingest food		
LOSE GOSS COMMUNICATION (Canberra)	93:20:24	
Activate tape recorder		
BEGIN CSM SYSTEMS CHECK (00:30:00)	93:40:00	
IFTS, G&N, SCS, EPS, ECS, SPS, SM-RCS		
	93:44:58	C-PREPARE EQUIPMENT FOR RETURN TO LEM (00:10:00)
ENTER SUNLIGHT	93:49:59	
	93:54:58	S-PREPARE FOR RETURN OF COMMANDER (00:02:10)
	93:54:58	S-Deactivate ground power & close face plate (00:00:10)
	93:55:08	S-Dump LEM cabin pressure (00:01:00)
	93:56:08	S-Open LEM hatch (00:01:00)
	93:57:08	C/S- LOAD EQUIPMENT (00:10:00)
	94:07:08	C-INGRESS TO LEM (00:02:10)
	94:07:08	C-Ascend into cabin (00:02:00)

<i>CSM</i>	<i>h:m:s</i>	<i>LEM</i>
<i>9.2 Lunar Orbit Coast (to Phase 13.0) (cont)</i>		<i>11.2 Lunar Exploration (cont)</i>
ACQUIRE GOSS COMMUNICATION (Madrid)	94:07:12	
ACQUIRE GOSS COMMUNICATION (Canberra)	94:07:48	
	94:09:08	C-Connect to ECS (00:00:10)
	94:09:08	S-INSTALL DROGUE (00:12:00)
	94:10:08	S-Remove drogue from upper hatch (00:05:00)
	94:15:08	S-Install drogue in forward hatch (00:05:00)
	94:20:08	C-Close LEM upper hatch (00:01:00)
	94:22:08	S-ESTABLISH CONDITIONS WITHIN S/C (00:02:00)
	94:22:08	S-Close LEM forward hatch (00:01:00)
	94:23:08	S-Begin GOX pressurization of cabin (00:01:00)
	94:24:08	S-Complete GOX pressurization of cabin & open face plates
	94:24:08	C-INITIATE NO. 1 PLSS REPLENISHMENT (00:03:00)
	94:27:08	C-BEGIN OFF-DUTY ACTIVITIES (00:45:00)
		C-Eat, rest
	94:27:50	S-COORDINATE WITH CSM (00:15:28)
	94:27:50	S-Activate LGC (00:00:10)
	94:28:00	S-LOS establishment with CSM & coordination
	94:28:00	S-Obtain CSM ephemeris to update LGC (00:01:00)

COORDINATE WITH LEM
Activate VHF (00:00:10)
Appear above landing site horizon
Verify required ascent orbit parameters

<i>CSM</i>	<i>h:m:s</i>	<i>LEM</i>
<i>9.2 Lunar Orbit Coast (to Phase 13.0) (cont)</i>		<i>11.2 Lunar Exploration (cont)</i>
Pass over landing site & record LEM data	94:35:29	
Disappear below landing site horizon	94:42:58	S- LOS blackout with CSM
Deactivate VHF (00:00:10)	94:42:58	S-Deactivate VHF (00:00:10)
START NAVIGATION (00:24:00)	94:43:00	
Perform, landmark navigation sightings		
Orbit ephemeris determination		
Perform landmark navigation sightings		
Orbit ephemeris determination		
LEAVE SUNLIGHT	94:43:08	S-Deactivate LGC (00:00:10)
	95:04:41	
	95:10:05	S-REPLACE LIOH CANISTER (00:02:00)
	95:12:08	C/S-SWITCH DUTY STATIONS (00:05:00)
	95:17:08	S-BEGIN OFF- FUTY ACTIVITIES (00:45:00)
		S-Eat, rest
LOSE GOSS COMMUNICATION (Canberra)	95:18:00	
LOSE GOSS COMMUNICATION (Madrid)	95:23:24	
Activate tape recorder		
ENTER SUNLIGHT	95:51:29	
ACQUIRE GOSS COMMUNICATION (Madrid)	96:10:12	
Enable S-band operation		

<i>CSM</i>	<i>h:m:s</i>	<i>LEM</i>
<i>9.2 Lunar Orbit Coast (to Phase 13.0) (cont)</i>		<i>11.2 Lunar Exploration (cont)</i>
TRACK LEM & COORDINATE		TRACK CSM & COORDINATE (00:33:28)
Activate rendezvous radar transponder (00:00:10)	96:11:14	Activate rendezvous radar transponder (00:00:10)
Activate rendezvous radar (00:00:10)	96:11:24	Activate rendezvous radar (00:00:10)
Activate VHF (00:00:10)	96:11:34	Activate G&N electronics (00:00:30)
	96:12:04	Activate VHF (00:00:10)
	96:12:04	Fine align IMU with AOT (00:15:00)
	96:27:14	Align BUGS (00:02:00)
Appear above landing site horizon	96:29:14	LOS establishment with CSM & coordination
Track LEM	96:29:14	Track CSM
Verify required ascent orbit parameters	96:29:14	Obtain CSM ephemeris to update LGC (00:01:00)
	96:30:14	Verify ascent trajectory parameters with CSM & GOSS
Pass over landing site & record LEM data	96:36:43	
Disappear below landing site horizon	96:44:12	LOS blackout with CSM
Deactivate rendezvous radar transponder (00:00:10)	96:44:12	Deactivate rendezvous radar transponder (00:00:10)
Deactivate rendezvous radar (00:00:10)	96:44:22	Deactivate rendezvous radar (00:00:10)
Deactivate VHF (00:00:10)	96:44:32	Deactivate VHF (00:00:10)
BEGIN CSM SYSTEMS CHECK (00:30:00)	96:45:00	
IFTIS, G&N, SCS, EPS, ECS, SPS, SM-RCS		

<i>CSM</i>	<i>h:m:s</i>	<i>LEM</i>
<i>9.2 Lunar Orbit Coast (to Phase 13.0) (cont)</i>		<i>11.3 Prelaunch Preparation</i>
	96:57:08	<p>START PRELAUNCH CHECKOUT (00:55:00)</p> <p>Activate use of ascent cryogenic tankage</p> <p>Initiate use of ascent cryogenic tankage</p> <p>Power generation</p> <p>Power distribution</p> <p>Initiate use of ascent water tankage</p> <p>ECS, RCS</p> <p>Ascent propulsion system pre-pressurization</p> <p>FC, SCS</p>
	97:06:11	LEAVE SUNLIGHT
	97:25:12	LOSE GOSS COMMUNICATION (Madrid)
		Activate tape recorder
	97:45:00	BEGIN CSM SYSTEMS CHECK (00:25:00)
	97:52:08	IIFTS, G&N, SCS, EPS, ECS
	97:52:08	PRESSURIZE ASCENT PROPULSION SYSTEM (00:05:00)
	97:52:18	Fire pressurization squib valves (00:00:10)
	97:52:59	Checkout ascent propulsion system
	97:57:08	ENTER SUNLIGHT
	97:59:08	<p>PREPARE FOR LAUNCH (00:39:59)</p> <p>Secure crew & equipment (00:02:00)</p> <p>Activate rendezvous radar transponder (00:00:10)</p>

CSM	h:m:s	LEM
<i>9.2 Lunar Orbit Coast (to Phase 13.0) (cont)</i>		<i>11.3 Prelaunch Preparation (cont)</i>
	97:59:18	Activate rendezvous radar (00:00:10)
	98:06:08	Activate IMU & LGC (00:01:00)
	98:07:08	Fine align IMU with AOT (00:15:00)
ACQUIRE GOSS COMMUNICATION (Madrid)	98:12:00	
Enable S-band operation		
	98:22:08	Align BUGS (00:02:00)
PREPARE FOR LEM LAUNCH		
Activate rendezvous radar transponder (00:00:10)	99:29:08	
Activate rendezvous radar (00:00:10)	99:29:18	
Activate VHF (00:00:10)	99:29:28	Activate VHF (00:00:10)
Appear above landing site horizon	99:30:28	LOS established with CSM
Track LEM	99:30:28	Track CSM
Confirm final ascent trajectory parameters	99:30:28	Verify ascent trajectory parameters with CSM & GOSS (00:03:00)
	99:34:00	Complete No. 1 PLSS replenishment
	99:34:18	Select automatic guidance mode (00:00:10)
	99:34:28	Arm ascent engine (00:00:10)
	99:36:38	Begin countdown to launch (00:00:30)
	99:36:38	Deactivate rendezvous radar (00:00:10)
	99:37:07	BEGIN ASCENT ENGINE IGNITION
	99:37:07	DESCENT STAGING

CSM	h:m:s	LEM
<i>9.2 Lunar Orbit Coast (to Phase 13.0) (cont)</i>		<i>12.0 LEM Ascent</i>
		<i>12.1 Powered Ascent to Transfer Orbit Insertion</i>
CONFIRM LEM LIFTOFF		LIFTOFF
	98:37:08	BEGIN VERTICAL RISE (00:00:10)
	98:37:08	Monitor attitude profile, including X-axis rotation
CONFIRM LEM PITCHOVER MANEUVER		BEGIN PITCHOVER MANEUVER (00:06:52)
PASS OVER LANDING SITE		Monitor attitude profile & Vg
	98:37:57	ASCENT ENGINE SHUTDOWN
	98:44:10	
		<i>12.2 Coast to Terminal Rendezvous</i>
		<i>12.2.1 Coasting Lunar Ascent to First Midcourse Correction</i>
CONFIRM TIME OF LEM ASCENT ENGINE SHUTDOWN		CONFIRM ASCENT TRANSFER ORBIT (00:02:10)
	98:44:10	Select attitude hold mode (00:00:10)
	98:44:20	Activate rendezvous radar & acquire CSM (00:02:00)
DISAPPEAR BELOW LANDING SITE HORIZON		
CHECK MUTUAL RADAR RANGING PARAMETERS	98:46:20	Check mutual radar ranging parameters (00:01:00)
CONFIRM LEM FIRST MCC PARAMETERS	98:47:20	Determine ascent transfer orbit parameters (00:01:00)
	98:51:00	PREPARE FOR FIRST MCC (00:01:40)

CSM	<i>h:m:s</i>	LEM
<i>9.2 Lunar Orbit Coast (to Phase 13.0) (cont)</i>		<i>12.2.1 Coasting Lunar Ascent to First Midcourse Correction (cont)</i>
	98:51:00	Determine first MCC parameters & coordinate with CSM (00:01:00)
	98:52:30	Select automatic guidance mode (00:00:10)
	98:52:40	Begin countdown for first MCC (00:00:30)
		<i>12.2.2 First Midcourse Correction</i>
	98:53:10	RCS FIRING FOR FIRST MCC (00:00:29) RCS translation thrusting automatically controlled
		Monitor time to RCS shutdown Vg & attitude RCS SHUTDOWN
	98:53:39	
		<i>12.2.3 Coast to Second Midcourse Correction</i>
	98:53:39	CONFIRM CORRECTED ASCENT TRAJECTORY ORBIT (00:02:10)
		Select attitude hold mode (00:00:10)
	98:53:39	Check mutual radar ranging parameters (00:01:00)
	98:54:49	Determine ascent transfer orbit parameters (00:01:00)
	99:02:24	LEAVE SUNLIGHT
	99:05:30	PREPARE FOR SECOND MCC (00:01:40)
	99:05:30	Determine second MCC parameters & coordinate with CSM (00:01:00)
		CONFIRM LEM SECOND MCC PARAMETERS

<i>CSM</i>	<i>h:m:s</i>	<i>LEM</i>
<i>9.2 Lunar Orbit Coast (to Phase 13.0) (cont)</i>		<i>12.2.3 Coast to Second Midcourse Correction (cont)</i>
	99:06:30	Select automatic guidance mode (00:00:10)
	99:06:40	Begin countdown for second MCC (00:00:30)
		<i>12.2.4 Second Midcourse Correction</i>
MONITOR LEM SECOND MCC		
	99:07:10	RCS FIRING FOR SECOND MCC (00:00:09) RCS translation thrusting automatically controlled
		Monitor time to RCS shutdown, Vg & attitude RCS SHUTDOWN
	99:07:19	
		<i>12.2.5 Coast to Third Midcourse Correction</i>
	99:07:19	CONFIRM CORRECT ASCENT TRAJECTORY ORBIT (00:02:10)
		Select attitude hold mode (00:00:10)
	99:07:29	Check mutual radar ranging parameters (00:01:00)
	99:07:41	
CHECK MUTUAL RADAR RANGING PARAMETERS	99:08:29	Determine ascent transfer orbit parameters (00:01:00)
LEAVE SUNLIGHT		
	99:11:24	LOSE GOSS COMMUNICATION
CONFIRM LEM THIRD MCC PARAMETERS	99:15:30	PREPARE FOR THIRD MCC (00:01:40)
	99:15:30	Determine third MCC parameters & coordinate with CSM (00:01:00)

<i>CSM</i>	<i>h:m:s</i>	<i>LEM</i>
<i>9.2 Lunar Orbit Coast (to Phase 13.0) (cont)</i>		<i>12. 2. 5 Coast to Third Midcourse Correction (cont)</i>
	99:16:30	Select automatic guidance mode (00:00:10)
	99:16:40	Begin countdown for third MCC (00:00:30)
		<i>12. 2. 6 Third Midcourse Correction</i>
MONITOR LEM THIRD MCC	99:17:10	RCS FIRING FOR THIRD MCC (00:00:04) RCS translation thrusting automatically controlled Monitor time to RCS shutdown, Vg attitude RCS SHUTDOWN
	99:17:14	<i>12. 2. 7 Coast to Terminal Rendezvous</i>
	99:17:14	CONFIRM CORRECTED ASCENT TRAJECTORY ORBIT (00:02:00)
	99:17:14	Null & monitor LOS rates
	99:17:14	Check mutual radar ranging parameters (00:01:00)
	99:18:14	Determine ascent transfer orbit parameters (00:01:00)
LOSE GOSS COMMUNICATION (Madrid) CONFIRM FIRST RENDEZVOUS PARA- METERS	99:27:00	
	99:27:09	PREPARE FOR FIRST RENDEZVOUS MANEUVER (5 n mi) (00:03:00)
	99:27:09	Determine first rendezvous maneuver parameters & coordinate with CSM (00:01:00)

<i>CSM</i>	<i>h.m.s</i>	<i>LEM</i>
<i>9.2 Lunar Orbit Coast (to Phase 13.0) (cont)</i>		<i>12.2.7 Coast to Terminal Rendezvous (cont)</i>
		Monitor commanded +Z-axis orientation by RCS along LOS to CSM (00:01:00) Begin countdown for first rendezvous maneuver (00:00:30)
	99:29:39	<i>12.3 Terminal Rendezvous</i>
		<i>12.3.1 First Thrusting</i>
MONITOR LEM FIRST RENDEZVOUS MANEUVER		RCS FIRING FOR FIRST RENDEZVOUS MANEUVER (00:00:35)
		Monitor commanded RCS translation thrusting
		Monitor range rate vs range profile
	99:30:44	RCS SHUTDOWN
		<i>12.3.2 Coast to Second Thrusting</i>
		CONFIRM FIRST RENDEZVOUS MANEUVER (00:01:00)
CHECK MUTUAL RADAR RANGING PARAMETERS	99:30:44	Null & monitor LOS rates
	99:30:44	Check mutual radar ranging parameters (00:00:30)
	99:31:14	Determine ascent transfer orbit parameters (00:00:30)
	99:31:44	DISARM ASCENT ENGINE (00:00:10)

CSM	<i>h:m:s</i>	LEM
<i>9.2 Lunar Orbit Coast (to Phase 13.0) (cont)</i>		<i>12.3.2 Coast to Second Thrusting (cont)</i>
CONFIRM SECOND RENDEZVOUS PARAMETERS		<p>PREPARE FOR SECOND RENDEZVOUS MANEUVER (1.5 n mi) (00:01:58)</p> <p>Determine second rendezvous maneuver parameters & coordinate with CSM (00:00:30)</p> <p>Monitor commanded +Z-axis orientation by RCS along LOS to CSM</p>
	99:31:44	<p>Begin countdown for second rendezvous maneuver (00:00:30)</p>
	99:33:12	
		<i>12.3.3 Second Thrusting</i>
MONITOR LEM SECOND RENDEZVOUS MANEUVER		<p>RCS FIRING FOR RENDEZVOUS MANEUVER (00:00:59)</p> <p>Monitor commanded RCS translation thrusting</p> <p>Monitor range range rate vs range profile</p>
	99:33:42	<p>RCS SHUTDOWN</p>
	99:34:41	
		<i>12.3.4 Coast to Third Thrusting</i>
	99:34:37	CONFIRM SECOND RENDEZVOUS MANEUVER (00:01:00)
	99:34:37	Null & monitor LOS rates

CSM	h:m:s	LEM
<i>9.2 Lunar Orbit Coast (to Phase 13.0) (cont)</i>		<i>12.3.4 Coast to Third Thrusting (cont)</i>
CHECK MUTUAL RADAR RANGING PARAMETERS	99:34:37	Check mutual radar range parameters (00:00:30)
CONFIRM THIRD RENDEZVOUS PARAMETERS	99:35:07	Determine ascent transfer orbit parameters (00:00:30)
	99:35:37	PREPARE FOR THIRD RENDEZVOUS MANEUVER (0.25 n mi) (00:01:54)
	99:35:37	Determine third rendezvous maneuver parameters & coordinate with CSM (00:00:30) Monitor commanded +Z-axis orientation by RCS along LOS to CSM (00:00:30)
	99:37:01	Begin countdown for third rendezvous maneuver (00:00:30)
		<i>12.3.5 Third Thrusting</i>
MONITOR LEM THIRD RENDEZVOUS MANEUVER	99:37:31	RCS FIRING FOR THIRD RENDEZVOUS MANEUVER (00:00:11) Monitor commanded RCS translation thrusting Monitor range rate vs range profile
	99:37:42	RCS SHUTDOWN
		<i>12.4 Docking</i>
	99:37:42	CONFIRM THIRD RENDEZVOUS MANEUVER (00:00:10)

CSM	h:m:s	LEM
9.2 Lunar Orbit Coast (to Phase 13.0) (cont)		12.4 Docking (cont)
CHECK MUTUAL RADAR RANGING PARAMETERS & CONFIRM VISUALLY PREPARE FOR DOCKING		
	99:37:42	Check mutual radar range parameters & confirm visually (00:00:10)
	99:37:52	BEGIN INITIAL LEM ACTIVE DOCKING (00:14:40)
	99:37:52	Select attitude hold mode (00:00:10)
	99:37:52	Activate attitude docking lights (00:00:10)
	99:38:02	Manually orient vehicle with +Z -axis aligned to LOS to CSM (00:00:10)
	99:38:12	Manually control range & range rate translation (00:14:20)
		Manually control attitude & attitude rate (00:14:20)
		Visually confirm maneuver utilizing docking sight, ranging information, & coordinate with CSM (00:14:20)
	99:49:12	ENTER SUNLIGHT
	99:52:32	BEGIN FINAL LEM ACTIVE DOCKING MANEUVER (00:00:10)
	99:52:32	Manually stabilize vehicle attitude
	99:52:32	Confirm final alignment with docking sight before contact.
	99:52:32	Select rate command mode
	99:52:40	Perform final manual translation thrust maneuver
	99:52:42	CSM/LEM SOFT DOCKING

<i>CSM</i>	<i>h:m:s</i>	<i>LEM</i>
<i>9.2 Lunar Orbit Coast (to Phase 13.0) (cont)</i>		<i>12.4 Docking (cont)</i>
Verify LEM drogue engagement of CSM probe	99:52:42	Verify LEM drogue engagement of CSM probe
	99:52:42	Static electrical equalization
<i>13.0 Lunar Orbit Coast to Transearth Injection</i>		
<i>13.1 Coast thru Crew Transfer</i>		
BEGIN INTERLOCK PRESSURIZATION (00:02:00)	99:52:42	C-DISARM RCS (00:00:05)
Interlock leak check operation (00:01:00)	99:52:42	
	99:52:42	S-BEGIN SHUTDOWN OF LEM SYSTEMS (00:02:00)
	99:52:42	S-Report final systems parameters (00:01:00)
	99:53:42	S-Deactivate equipment (00:01:00)
ENTER SUNLIGHT	99:54:29	
	99:54:42	C-OPEN LEM CABIN RELIEF & DUMP VALVE, & LEM HATCH (00:01:00)
	99:54:42	S-PREPARE EQUIPMENT, SPECIMENTS, & RECORDS FOR TRANSFER TO CSM (00:10:00)
	99:55:42	C- LEM/CSM HARD DOCKING (00:05:00)
COMPLETE LEM/CSM HARD DOCKING	100:00:42	C-REMOVE & STOW DOCKING MECHANISM IN LEM (00:10:00)
Confirm hard docking		
Open CSM hatch		

<i>CSM</i>	<i>h:m:s</i>	<i>LEM</i>
<i>13. 1 Coast thru Crew Transfer (cont)</i>		
	100:00:42	C-Remove & stow LEM drogue in LEM (00:05:00)
BEGIN LEM CREW & EQUIPMENT TRANSFER (00:12:00)	100:05:42	C-Remove & stow CSM probe in LEM (00:05:00)
	100:10:42	C- TRANSFER TO CSM (00:01:00)
	100:11:42	S-TRANSFER EQUIPMENT TO CSM (00:07:00)
ACQUIRE GOSS COMMUNICATION (Madrid) Enable S-band operation	100:13:48	ACQUIRE GOSS COMMUNICATIONS
	100:18:42	S- TRANSFER TO CSM (00:04:00)
	100:18:42	S-Transfer into interlock (00:01:00)
	100:19:42	S-Close LEM hatch (00:01:00)
	100:20:42	S-Transfer into CSM (00:01:00)
CLOSE CSM HATCH (00:01:00)	100:21:42	
<i>13. 2 Coast to LEM Jettison</i>		
BEGIN PREPARATION TO JETTISON LEM (00:10:00)	100:22:42	
Enter pressure suit environment & secure restraints		
APPEAR ABOVE LANDING SITE HORIZON	100:31:42	

<i>CSM</i>	<i>h.m.s</i>	<i>LEM</i>
<i>13.3 Transearth Injection Preparation</i>		
<i>13.3.1 Jettison LEM</i>		
JETTISON LEM (00:01:18)	100:32:41	
<i>13.3.2 Coast to Transearth Injection Preparation</i>		
BEGIN POST-JETTISON CHECK (00:05:00)	100:33:58	
Communicate to GOSS		
Release restraints		
BEGIN IMU ALIGNMENT (00:12:00)		
IMU fine alignment		
SCS attitude alignment		
IMU fine alignment check		
BEGINS SYSTEMS CHECK (00:13:00)	100:39:00	
IFTS, EPS, SPS, SM-RCS, CM-RCS		
PASS OVER LANDING SITE	100:39:11	
DISAPPEAR BELOW LANDING SITE	100:46:40	
HORIZON		
START NAVIGATION (00:12:00)	100:51:00	
Perform orbital landmark navigation		
sighting		
Obtain present trajectory error & ephemeris		
miss-distance data		
LEAVE SUNLIGHT	101:09:11	
ACQUIRE GOSS COMMUNICATION (Austin)	101:12:00	

<i>CSM</i>	<i>h:m:s</i>	<i>LEM</i>
<i>13. 3.2 Coast to Transearth Injection Preparation (cont)</i>		
BEGIN CES OPERATIONS (00:15:00)	101:15:00	
Prepare & ingest food		
LOSE GOSS COMMUNICATION (Austin)	101:28:48	
LOSE GOSS COMMUNICATION (Madrid)	101:29:24	
Activate tape recorder		
BEGIN SYSTEMS CHECK (00:30:00)	101:39:00	
IFTS, G&N, SCS, EPS, ECS, SPS, SM-RCS, CM-RCS		
ENTER SUNLIGHT	101:55:59	
ACQUIRE GOSS COMMUNICATION (Austin)	102:15:36	
Enable S-band operation		
ACQUIRE GOSS COMMUNICATION (Madrid)	102:16:48	
START NAVIGATION (00:36:00)	102:29:00	
Perform orbital landmark navigation sighting		
Obtain present trajectory error & ephemeris miss-distance data		
Perform orbital landmark navigation sighting		
Obtain present trajectory error & ephemeris miss-distance data		
Perform orbital landmark navigation sighting		
Obtain present trajectory error & ephemeris miss-distance data		

<i>CSM</i>	<i>h:m:s</i>	<i>LEM</i>
<i>13. 3.2 Coast to Transearth Injection Preparation (cont)</i>		
APPEAR ABOVE LANDING SITE HORIZON	102:32:56	
BEGIN SYSTEMS CHECK (00:10:00)	102:39:00	
IFTS, EPS, ECS, SM-RCS		
PASS OVER LANDING SITE	102:40:25	
DISAPPEAR BELOW LANDING SITE HORIZON	102:47:54	
<i>13. 3.3 Transearth Injection Preparation</i>		
BEGIN FINAL PREPARATION FOR TEI (0:30:00)	102:59:10	
TEI parameter data acquisition		
IMU fine alignment		
SCS attitude alignment		
IMU fine alignment check		
SCS, G&N		
Replace CO ₂ Cartridge CES, SM-RCS	103:10:41	
LEAVE SUNLIGHT	103:25:48	
LOSE GOSS COMMUNICATION (Austin & Madrid)		
Activate tape recorder		
SM-RCS IGNITION	103:29:07	

	<i>CSM</i>	<i>h:m:s</i>	<i>LEM</i>
<i>14. 0 Transearth Injection</i>			
PROPELLION SYSTEM IGNITION (00:01:51)		103:29:10	
Program injection maneuver monitoring			
ACQUIRE GOSS COMMUNICATION (Austin & Madrid)		103:29:24	
LOSE GOSS COMMUNICATION (Austin & Madrid)		103:30:36	
SPS CUTOFF		103:31:01	
<i>15. 0 Transearth Coast</i>			
<i>15. 1 Coast thru First Midcourse Correction</i>			
<i>15. 1. 1 Coast to First Midcourse Correction</i>			
START S/C SYSTEMS CHECK (00:30:00)		103:31:01	
IFTS, G&N, SCS, EPS, SPS, SM-RCS, CM-RCS			
IMU TO STANDBY		103:31:01	
DOFF PRESSURE SUITS (00:09:00)		103:32:01	
BEGIN REST CYCLE (02:45:00)		103:41:01	
Astronaut No. 1 - rest			
Astronaut No. 2 - active			
Astronaut No. 3 - active			
ACQUIRE GOSS COMMUNICATION (Austin & Madrid)		103:53:24	
SYSTEMS CHECK (00:15:00)		104:31:01	
IFTS, G&N, SCS, EPS, ECS			

<i>CSM</i>	<i>h:m:s</i>	<i>LEM</i>
<i>15.1.1 Coast to First Midcourse Correction (cont)</i>		
LOSE GOSS COMMUNICATION (Madrid) SYSTEMS CHECK (00:15:00) IFTS, G&N, SCS, EPS, ECS START NAVIGATION (00:20:00)	104:40:48 105:31:01 106:02:06	
Navigation sighting (IMU on standby) Obtain present trajectory error & ephemeris miss-distance data SCS attitude alignment		
DOFF & DON PRESSURE SUITS (00:15:00) SYSTEMS CHECK (00:15:00) IFTS, G&N, SCS, EPS, ECS	106:26:01 106:31:01	
CONTINUE REST CYCLE (03:00:00)	106:41:01	
Astronaut No. 1 - active Astronaut No. 2 - active Astronaut No. 3 - rest		
SYSTEMS CHECK (00:30:00) IFTS, G&N, SCS, EPS, ECS, SPS, SM-RCS Carbon dioxide & odor absorber cartridge replaced	107:31:01	
SYSTEMS CHECK (00:15:00) IFTS, G&N, SCS, EPS, ECS START NAVIGATION (00:20:00)	108:31:01 109:02:06	Navigational Sighting (IMU on standby)

<i>CSM</i>	<i>h:m:s</i>	<i>LEM</i>
<i>15.1.1 Coast to First Midcourse Correction (cont)</i>		
Obtain present trajectory error & ephemeris miss-distance data		
SCS attitude alignment		
ACQUIRE GOSS COMMUNICATION (Canberra)	109:01:12	
SYSTEMS CHECK (00:20:00)	109:31:01	
IFTs, G&N, SCS, EPS, ECS		
Entry batteries, post landing battery, & PLSS battery charge		
DOFF & DON PRESSURE SUIT (00:15:00)	109:41:00	
CONTINUE REST CYCLE (02:45:00)	109:56:00	
Astronaut No. 1 - active		
Astronaut No. 2 - rest		
Astronaut No. 3 - active	110:31:01	
SYSTEMS CHECK (00:15:00)		
IFTs, G&N, SCS, EPS, ECS		
SYSTEM CHECK (00:30:00)	111:31:01	
IFTs, G&N, SCS, EPS, ECS, SPS, SM-RCS		
Fuel cell purge		
LOSE GOSS COMMUNICATION (Austin)	111:37:12	
SYSTEMS CHECK (00:15:00)	112:31:01	
IFTs, G&N, SCS, EPS, ECS		
DOFF & DON PRESSURE SUITS (00:15:00)	112:41:00	

<i>CSM</i>	<i>h:m:s</i>	<i>LEM</i>
<i>15.1.1 Coast to First Midcourse Correction (cont)</i>		
START CES OPERATIONS	112:51:07	
Prepare & ingest food	112:56:00	
CONTINUE REST CYCLE (07:45:00)		
Astronaut No. 1 - Active		
Astronaut No. 2 - Active		
Astronaut No. 3 - Rest		
SYSTEMS CHECK (00:15:00)	113:31:01	
IFTS, G&N, SCS, EPS, ECS		
SYSTEMS CHECK (00:15:00)	114:31:01	
IFTS, G&N, SCS, EPS, ECS		
START NAVIGATION (00:20:00)	115:02:06	
Navigational sighting (IMU on standby)		
Obtain present trajectory error & ephemeris		
miss-distance data		
SCS attitude alignment		
SYSTEMS CHECK (00:30:00)	115:31:01	
IFTS, G&N, SCS, EPS, ECS, SPS, SM-RCS		
CM-RCS		
Entry batteries, post-landing battery, &		
PLSS battery charge		
SYSTEM CHECK (00:15:00)	116:31:01	
IFTS, G&N, SCS, EPS, ECS		
SYSTEMS CHECK (00:15:00)	117:31:01	

<i>CSM</i>	<i>h:m:s</i>	<i>LEM</i>
<i>15.1.1 Coast to First Midcourse Correction (cont)</i>		
IPTS, G&N, SCS, EPS, ECS START NAVIGATION (00:23:00) Navigational sighting (IMU on standby) Obtain present trajectory error & ephemeris miss-distance data SCS attitude alignment Obtain next delta-V correction parameter data	118:02:06	
SYSTEMS CHECK (00:15:00)	118:31:01	
IPTS, G&N, SCS, EPS, ECS ACQUIRE GOSS COMMUNICATION (Madrid)	118:49:12	
LOSE GOSS COMMUNICATION (Canberra)	119:07:12	
SYSTEMS CHECK (00:35:00)	119:31:01	
IPTS, G&N, SCS, EPS, ECS, SPS, SM-RCS Fuel cell purge Carbon dioxide & odor absorber cartridge replaced		
START CES OPERATIONS	119:51:07	
Prepare & ingest food		
START NAVIGATION (00:23:00) Navigational sighting (IMU on standby) Obtain present trajectory error & ephemeris miss-distance data SCS attitude alignment	120:02:06	

<i>CSM</i>	<i>h:m:s</i>	<i>LEM</i>
<i>15.1 Coast to First Midcourse Correction (cont)</i>		
Obtain next delta-V correction parameter data		
SYSTEMS CHECK (00:15:00) IFTS, G&N, SCS, EPS, ECS DOFF & DON PRESSURE SUITS (00:15:00) CONTINUE REST CYCLE (08:00:00)	120:31:01 120:41:00 120:56:00	
Astronaut No. 1 - rest Astronaut No. 2 - active Astronaut No. 3 - active		
SECOND PREPARATION (00:35:00)	120:57:07 120:57:07	
IMU coarse alignment IMU fine alignment SCS attitude alignment		
IMU fine alignment check SCS, G&N, CES, SM-RCS SM-RCS ullage acceleration		
<i>15.1.2 First Midcourse Correction</i>		
POWER PHASE SPS firing	121:21:04	

CSM	h:m:s	LEM
<i>15.2 Coast thru Second Midcourse Correction</i>		
<i>15.2.1 Coast to Second Midcourse Correction</i>		
VERIFICATION Confirm delta-V acquisition SPS, SM-RCS securing after delta-V START S/C SYSTEMS CHECK (00:30:00) IFTS, G&N, SCS, EPS, ECS, SPS, SM-RCS, CM-RCS	121:21:07	
Entry batteries, post-landing battery, & PLSS battery charge		
IMU TO STANDBY SYSTEMS CHECK (00:15:00) IFTS, G&N, SCS, EPS, ECS	121:26:10 122:36:00	
SYSTEM CHECK (00:15:00) IFTS, G&N, SCS, EPS, ECS	123:36:00	
START NAVIGATION (00:20:00)	124:31:01	
Navigational sighting (IMU on standby) Obtain present trajectory error & ephemeris miss-distance data		
SCS attitude alignment SYSTEMS CHECK (00:15:00) IFTS, G&N, SCS, EPS, ECS	124:51:00	
ACQUIRE GOSS COMMUNICATION (Austin)	125:19:12	

CSM	h:m:s	LEM
<i>15.2.1 Coast to Second Midcourse Correction (cont)</i>		
SYSTEMS CHECK (00:25:00) IFTS, G&N, SCS, EPS, ECS, SPS, SM-RCS	126:36:00	
SYSTEMS CHECK (00:15:00) IFTS, G&N, SCS, EPS, ECS	126:36:00	
SYSTEMS CHECK (00:25:00) IFTS, G&N, SCS, EPS, ECS	127:36:00	
Fuel cell purge Entry batteries, post landing battery, & PLSS battery charge	127:49:59	
START CES OPERATIONS Prepare & ingest food	128:31:01	
START NAVIGATION (00:20:00) Navigational sighting (IMU on standby) Obtain present trajectory error & ephemeris miss-distance data		
SCS attitude alignment LOSE GOSS COMMUNICATION (Madrid)	128:37:12	
SYSTEM CHECK (00:15:00) IFTS, G&N SCS, EPS, ECS	128:51:00	
DOFF & DON PRESSURE SUITS (00:15:00) CONTINUE REST CYCLE (07:45:00)	128:56:00	
Astronaut No. 1 - active	129:11:00	

CSM	<i>h:m:s</i>	LEM
<i>15.2.1 Coast to Second Midcourse Correction (cont)</i>		
Astronaut No. 2 - rest		
Astronaut No. 3 - active		
SYSTEM CHECK (00:25:00)		
IFTS, G&N, SCS, EPS, ECS, SPS, SM-RCS	129:36:00	
SYSTEMS CHECK (00:15:00)		
IFTS, G&N, SCS, EPS, ECS	130:36:00	
SYSTEMS CHECK (00:27:00)		
IFTS, G&N, SCS, EPS, ECS	131:36:00	
Carbon dioxide & odor absorber cartridge replaced		
START NAVIGATION (00:20:00)	132:31:01	
Navigational sighting (IMU on standby)		
Obtain present trajectory error & ephemeris miss-distance data		
SCS attitude alignment		
SYSTEMS CHECK (00:15:00)	132:51:00	
IFTS, G&N, SCS, EPS, ECS		
ACQUIRE GOSS COMMUNICATION (Canberra & Madrid)	133:07:12	
SYSTEMS CHECK (00:30:00)		
IFTS, G&N, SCS, EPS, ECS, SPS, SM-RCS, CM-RCS	133:36:00	
Entry batteries, post landing battery, & PLSS battery charge		

CSM	h:m:s	LEM
<i>15.2.1 Coast to Second Midcourse Correction (cont)</i>		
SYSTEMS CHECK (00:15:00) IFTS, G&N, SCS, EPS, ECS	134:36:00	
SYSTEMS CHECK (00:20:00) IFTS, G&N, SCS, EPS, ECS	135:36:00	
Fuel cell purge		
LOSE GOSS COMMUNICATION (Austin)	135:43:12	
START CES OPERATIONS Prepare & ingest food	135:49:59	
START NAVIGATION (00:20:00) Navigational sighting (IMU on standby)	136:31:01	
Obtain present trajectory error & ephemeris miss-distance data		
SCS attitude alignment		
SYSTEMS CHECK (00:15:00) IFTS, G&N, SCS, EPS, ECS	136:51:00	
DOFF & DON PRESSURE SUITS (00:15:00)	136:56:00	
CONTINUE REST CYCLE (08:00:00)	137:11:00	
Astronaut No. 1 - active		
Astronaut No. 2 - active		
Astronaut No. 3 - rest		
SYSTEMS CHECK (00:25:00) IFTS, G&N, SCS, EPS, ECS, SPS, SM-RCS	137:36:00	
SYSTEMS CHECK (00:15:00)	138:36:00	

CSM	h:m:s	LEM
<i>15.2.1 Coast to Second Midcourse Correction (cont)</i>		
IFTS, G&N, SCS, EPS, ECS SYSTEMS CHECK (00:20:00)	139:36:00	
IFTS, G&N, SCS, EPS, ECS Entry batteries, post- landing battery, & PLSS battery charge		
START NAVIGATION (00:20:00)	140:31:01	
Navigational sighting (IMU on standby) Obtain present trajectory error & ephemeris miss-distance data		
SCS attitude alignment		
SYSTEMS CHECK (00:15:00)	140:51:00	
IFTS, G&N, SCS, EPS, ECS		
SYSTEMS CHECK (00:25:00)	141:36:00	
IFTS, G&N, SCS, EPS, ECS, SPS, SM-RCS		
SYSTEM CHECK (00:15:00)	142:36:00	
IFTS, G&N, SCS, EPS, ECS		
LOSE GOSS COMMUNICATION (Canberra)	143:07:12	
SYSTEMS CHECK (00:25:00)	143:36:00	
IFTS, G&N, SCS, EPS, ECS		
Fuel cell purge		
Carbon dioxide & odor absorber cartridge replaced		
START CES OPERATIONS		
Prepare & ingest food	143:49:59	

<i>CSM</i>	<i>h:m:s</i>	<i>LEM</i>
<i>15.2.1 Coast to Second Midcourse Correction (cont)</i>		
START NAVIGATION (00:20:00) Navigational sighting (IMU on standby) Obtain present trajectory error & ephemeris miss-distance data SCS attitude alignment	144:31:01	
SYSTEMS CHECK (00:15:00) IFTS, G&N, SCS, EPS, ECS	144:51:00	
DOFF & DON PRESSURE SUITS (00:15:00)	145:11:00	
CONTINUE REST CYCLE (07:45:00)	145:26:00	
Astronaut No. 1 - rest		
Astronaut No. 2 - active		
Astronaut No. 3 - active		
SYSTEMS CHECK (00:30:00) IFTS, G&N, SCS, EPS, ECS, SPS, SM-RCS, CM-RCS	145:36:00	
Entry batteries, post-landing battery, & PLSS battery charge		
SYSTEMS CHECK (00:15:00) IFTS, G&N, SCS, EPS, ECS	146:36:00	
SYSTEMS CHECK (00:15:00) IFTS, G&N, SCS, EPS, ECS	147:36:00	

CSM	h:m:s	LEM
<i>15.2.1 Coast to Second Midcourse Correction (cont)</i>		
SYSTEMS CHECK (00:25:00) IFTS, G&N, SCS, EPS, ECS, SPS, SM-RCS SYSTEMS CHECK (00:15:00)	148:36:00 149:36:00	
IFTS, G&N, SCS, EPS, ECS ACQUIRE GOSS COMMUNICATION (Austin)		149:37:12
SYSTEMS CHECK (00:25:00) IFTS, G&N, SCS, EPS, ECS Fuel cell purge		150:36:00
Carbon dioxide & odor absorber cartridge replaced		
START CES OPERATIONS	150:49:59	
Prepare & ingest food		
START NAVIGATION (00:20:00)	151:31:01	
Navigational sighting (IMU on standby)		
Obtain present trajectory error & ephemeris miss-distance data		
SCS attitude alignment		
SYSTEMS CHECK (00:15:00) IFTS, G&N, SCS, EPS, ECS SYSTEMS CHECK (00:30:00)	151:51:00 152:36:00	
IFTS, G&N, SCS, EPS, ECS, SPS, SM-RCS, CM-RCS		
Entry batteries, post-landing battery & PLSS battery charge		

<i>CSM</i>	<i>h:m:s</i>	<i>LEM</i>
<i>15.2.1 Coast to Second Midcourse Correction (cont)</i>		
LOSE GOSS COMMUNICATION (Madrid)	152:37:12	
DOFF & DON PRESSURE SUITS (00:15:00)	153:09:00	
CONTINUE REST CYCLE (08:00:00)	153:26:00	
Astronaut No. 1 - active		
Astronaut No. 2 - rest		
Astronaut No. 3 - active		
SYSTEMS CHECK (00:15:00)	153:36:00	
IFTS, G&N, SCS, EPS, ECS		
SYSTEMS CHECK (00:15:00)	154:36:00	
IFTS, G&N, SCS, EPS, ECS		
START NAVIGATION (00:20:00)	155:31:01	
Navigational sighting (IMU on standby)		
Obtain present trajectory error & ephemeris miss-distance data		
SCS attitude alignment		
SYSTEMS CHECK (00:15:00)	155:51:00	
IFTS, G&N, SCS, EPS, ECS		
SYSTEMS CHECK (00:25:00)	156:36:00	
IFTS, G&N, SCS, ECS, SPS, EPS, SM-RCS,		
ACQUIRE GOSS COMMUNICATION (Canberra)	157:25:12	

<i>CSM</i>	<i>h:m:s</i>	<i>LEM</i>
<i>15.2.1 Coast to Second Midcourse Correction (cont)</i>		
SYSTEMS CHECK (00:15:00) IFTS, G&N, SCS, EPS, ECS	157:36:00	
SYSTEMS CHECK (00:25:00) IFTS, G&N, SCS, EPS, ECS	158:36:00	
Fuel cell purge		
Entry batteries, post-landing battery, & PLSS battery charge		
START CES OPERATIONS	158:49:59	
Prepare & ingest food	159:31:01	
START NAVIGATION (00:20:00)		
Navigational sighting (IMU on standby)		
Obtain present trajectory error & ephemeris miss-distance data		
SCS attitude alignment		
LOSE GOSS COMMUNICATION (Austin)	159:43:12	
SYSTEMS CHECK (00:15:00) IFTS, G&N, SCS, EPS, ECS	159:51:00	
SYSTEMS CHECK (00:25:00) IFTS, G&N, SCS, EPS, ECS, SPS, SM-RCS	160:36:00	
DOFF & DON PRESSURE SUITS (00:15:00)	161:26:00	
CONTINUE REST CYCLE (07:45:00)	161:41:00	
Astronaut No. 1 - active		
Astronaut No. 2 - active		
Astronaut No. 3 - rest		

CSM	h:m:s	LEM
15.2.1 Coast to Second Midcourse Correction (cont)		
START NAVIGATION (00:20:00) Navigational sighting (IMU on standby) Obtain present trajectory error & ephemeris miss-distance data	161:31:01	
SCS attitude alignment		
SYSTEMS CHECK (00:15:00) IFTS, G&N, SCS, EPS, ECS	161:51:00	
SYSTEMS CHECK (00:27:00) IFTS, G&N, SCS, EPS, ECS	162:36:00	
Carbon dioxide & odor absorber cartridge replaced		
START NAVIGATION (00:20:00) Navigational sighting (IMU on standby) Obtain present trajectory error & ephemeris miss-distance data	163:31:01	
SCS attitude alignment		
SYSTEMS CHECK (00:15:00) IFTS, G&N, SCS, EPS, ECS	163:51:00	
SYSTEMS CHECK (00:30:00) IFTS, G&N, SCS, EPS, ECS, EPS, SM-RCS, CM-RCS	164:36:00	
Entry batteries, post-landing battery, & PLSS battery charge		
START NAVIGATION (00:23:00)	165:31:01	

CSM	<i>h:m:s</i>	LEM
<i>15.2.1 Coast to Second Midcourse Correction</i>		
Navigational sighting (IMU on standby)		
Obtain present trajectory error & ephemeris miss-distance data		
SCS attitude alignment		
Obtain next delta-V correction parameter data		
SYSTEMS CHECK (00:15:00)	165:54:00	
IFTS, G&N, SCS EPS, ECS		
SYSTEMS CHECK (00:20:00)	166:36:00	
IFTS, G&N, SCS, EPS, ECS		
Fuel cell purge		
START CES OPERATIONS	166:49:59	
Prepare & ingest food		
LOSE GOSS COMMUNICATION (Canberra)	167:07:12	
ACQUIRE GOSS COMMUNICATION (Madrid)	167:25:12	
START NAVIGATION (00:23:00)	167:30:01	
Navigational sighting (IMU on standby)		
Obtain present trajectory error & ephemeris miss-distance data		
SCS attitude alignment		
Obtain next delta-V correction parameter data		
SECOND DELTA-V PREPARATION (00:35:00)	167:55:00	
IMU course alignment		
IMU fine alignment		

	<i>CSM</i>	<i>h:m:s</i>	<i>LEM</i>
<i>15.2.1 Coast to Second Midcourse Correction (cont)</i>			
SCS attitude alignment			
IMU fine alignment check			
SCS, G&N, CES, SM-RCS			
SM-RCS ullage acceleration			
<i>15.2.2 Second Midcourse Correction</i>			
DELTA-V POWER PHASE (00:00:03)	168:30:04		
SPS firing			
<i>15.3 Coast thru Third Midcourse Correction</i>			
<i>15.3.1 Coast to Third Midcourse Correction</i>			
DELTA-V VERIFICATION (00:05:00)	168:30:07		
Confirm delta-V acquisition			
SPS, SM-RCS securing after delta V			
IMU TO STANDBY	168:40:00		
START S/C SYSTEMS CHECK (00:30:00)	168:40:00		
IFTS, G&N, SCS, EPS, SPS, SM-RCS,			
CM-RCS			
DOFF & DON PRESSURE SUITS (00:15:00)	169:26:00		
CONTINUE REST CYCLE (08:00:00)	169:41:00		
Astronaut No. 1 - rest			

<i>CSM</i>	<i>h:m:s</i>	<i>LEM</i>
<i>15.3.1 Coast to Third Midcourse Correction (cont)</i>		
Astronaut No. 2 - active		
Astronaut No. 3 - active		
SYSTEMS CHECK (00:15:00)	169:44:53	
IFTS, G&N, SCS, EPS, ECS		
SYSTEMS CHECK (00:15:00)	170:44:53	
IFTS, G&N, SCS, EPS, ECS		
START NAVIGATION (00:20:00)	171:39:50	
Navigational sighting (IMU on standby)		
Obtain present trajectory error & ephemeris miss-distance data		
SCS attitude alignment		
SYSTEMS CHECK (00:20:00)	171:59:53	
IFTS, G&N, SCS, EPS, ECS		
Entry batteries, post-landing battery, & PLSS battery charge		
SYSTEMS CHECK (00:25:00)	172:44:53	
IFTS, G&N, SCS, EPS, ECS, SPS, SM-RCS		
SYSTEMS CHECK (00:15:00)	173:44:53	
IFTS, G&N, SCS, EPS, ECS		
ACQUIRE GOSS COMMUNICATION (Austin)	174:07:12	
START NAVIGATION (00:20:00)	174:39:50	
Navigational sighting (IMU on standby)		
Obtain present trajectory error & ephemeris miss-distance data		

<i>CSM</i>	<i>h:m:s</i>	<i>LEM</i>
<i>15.3.1 Coast to Third Midcourse Correction (cont)</i>		
SCS attitude alignment		
START CES OPERATIONS	174:58:52	
Prepare & ingest food	174:59:53	
SYSTEMS CHECK (00:15:00) IFTS, G&N, SCS, EPS, ECS	175:44:53	
SYSTEMS CHECK (00:25:00) IFTS, G&N, SCS, EPS, ECS		
Fuel cell purge		
Carbon dioxide & odor absorber cartridge replaced	176:37:12	
LOSE GOSS COMMUNICATION (Madrid)		
SYSTEMS CHECK (00:25:00) IFTS, G&N, SCS, EPS, ECS, SPS, SM-RCS	176:44:53	
START NAVIGATION (00:20:00)	177:39:50	
Navigational sighting (IMU on standby)		
Obtain present trajectory error & ephemeris miss-distance data		
SCS attitude alignment		
DOFF & DON PRESSURE SUITS (00:15:00)	177:41:00	
CONTINUE REST CYCLE (07:45:00)	177:56:00	
Astronaut No. 1 - active		
Astronaut No. 2-rest		
Astronaut No. 3 - active		

CSM	<i>h:m:s</i>	LEM
<i>15.3.1 Coast to Third Midcourse Correction (cont)</i>		
SYSTEMS CHECK (00:20:00) IFTS, G&N, SCS, EPS, ECS Entry batteries, post-landing battery, & PLSS battery charge	177:59:53	
SYSTEMS CHECK (00:15:00) IFTS, G&N, SCS, EPS, ECS	178:44:53	
SYSTEMS CHECK (00:15:00) IFTS, G&N, SCS, EPS, ECS	179:44:53	
START NAVIGATION (00:20:00) Navigational sighting (IMU on standby) Obtain present trajectory error & ephemeris miss-distance data SCS attitude alignment	180:39:50	
SYSTEMS CHECK (00:25:00) IFTS, G&N, SCS, EPS, ECS, SPS, SM-RCS	180:59:53	
SYSTEMS CHECK (00:15:00) IFTS, G&N, SCS, EPS, ECS	181:44:53	
ACQUIRE GOSS COMMUNICATION (Canberra) START NAVIGATION (00:20:00) Navigational sighting (IMU on standby) Obtain present trajectory error & ephemeris miss-distance data SCS attitude alignment	182:19:12 182:39:50	

<i>CSM</i>	<i>h:m:s</i>	<i>LEM</i>
<i>15.3.1 Coast to Third Midcourse Correction (cont)</i>		
START CES OPERATIONS	182:58:52	
Prepare & ingest food	182:59:53	
SYSTEMS CHECK (00:15:00) IFTS, G&N, SCS, EPS, ECS		
SYSTEMS CHECK (00:25:00) IFTS, G&N, SCS, EPS, ECS	183:44:53	
Fuel cell purge		
Entry batteries, post-landing battery, & PLSS battery charge		
LOSE GOSS COMMUNICATION (Austin)	183:49:12	
START NAVIGATION (00:20:00)	184:39:50	
Navigational sighting (IMU on standby)		
Obtain present trajectory error & ephemeris miss-distance data		
SCS attitude alignment		
SYSTEMS CHECK (00:25:00) IFTS, G&N, SCS, EPS, ECS, SPS, SM-RCS	184:59:53	
DOFF & DON PRESSURE SUITS (00:15:00)	185:41:00	
SYSTEMS CHECK (00:15:00) IFTS, G&N, SCS EPS, ECS	185:44:53	
CONTINUE REST CYCLE (08:00:00)	185:56:00	
Astronaut No. 1 - active		
Astronaut No. 2 - active		
Astronaut No. 3 - rest		

<i>CSM</i>	<i>h:m:s</i>	<i>LEM</i>
<i>15.3.1 Coast to Third Midcourse Correction (cont)</i>		
START NAVIGATION (00:20:00) Navigational sighting (IMU on standby) Obtain present trajectory error & ephemeris miss-distance data	186:39:50	
SCS attitude alignment		
SYSTEMS CHECK (00:15:00) IFTS, G&N, SCS, EPS, ECS	186:59:53	
START NAVIGATION (00:15:00) Navigational sighting (IMU on standby) Obtain present trajectory error & ephemeris miss-distance data	187:39:50	
SYSTEMS CHECK (00:27:00) IFTS, G&N, SCS, EPS, ECS	187:54:54	
Carbon dioxide & odor absorber cartridge replaced		
START NAVIGATION (00:15:00) Navigational sighting (IMU on standby) Obtain present trajectory error & ephemeris miss-distance data	188:39:50	
SYSTEMS CHECK (00:25:00) IFTS, G&N, SCS, EPS, ECS, SPS, SM-RCS	188:54:54	
START NAVIGATION (00:20:00) Navigational sighting (IMU on standby)	189:39:50	

<i>CSM</i>	<i>h:m:s</i>	<i>LEM</i>
<i>15.3.1 Coast to Third Midcourse Correction (cont)</i>		
Obtain present trajectory error & ephemeris miss-distance data SCS attitude alignment		
SYSTEMS CHECK (00:20:00) IFTS, G&N, SCS, EPS, ECS	189:59:53	
Entry batteries, post- landing battery, & PLSS battery charge		
START NAVIGATION (00:15:00) Navigational sighting (IMU on standby)	190:39:50	
Obtain present trajectory error & ephemeris miss-distance data		
SYSTEMS CHECK (00:15:00) IFTS, G&N, SCS, EPS, ECS	190:54:54	
LOSE GOSS COMMUNICATION (Canberra)	191:13:12	
START NAVIGATION (00:15:00) Navigational sighting (IMU on standby)	191:39:50	
Obtain present trajectory error & ephemeris miss-distance data		
ACQUIRE GOSS COMMUNICATION (Guam & Carnarvon)	191:43:12	
SYSTEMS CHECK (00:15:00) IFTS, G&N, SCS, EPS, ECS	191:55:00	
LOSE GOSS COMMUNICATION (Guam)	192:07:12	
START NAVIGATION (00:18:00)	192:10:00	

CSM	h:m:s	LEM
<i>15.3.1 Coast to Third Midcourse Correction (cont)</i>		
Navigational sighting (IMU on standby) Obtain present trajectory error & ephemeris miss-distance data Obtain next delta-V correction parameter data START NAVIGATION (00:23:00)	192:25:00	
Navigational sighting (IMU on standby) Obtain present trajectory error & ephemeris miss-distance data Obtain next delta-V correction parameter data SCS attitude alignment START CES OPERATION	192:30:00	
Prepare & ingest food START NAVIGATION (00:18:00)	192:45:00	
Navigational sighting (IMU on standby) Obtain present trajectory error & ephemeris miss-distance data Obtain next delta-V correction parameter data THIRD DELTA-V PREPARATION (00:35:00)	193:00:00	
IMU coarse alignment IMU fine alignment SCS attitude alignment IMU fine alignment check SCS, G&N, ECS, SM-RCS SM-RCS ullage acceleration		

<i>CSM</i>	<i>h:m:s</i>	<i>LEM</i>
<i>15.3.2 Third Midcourse Correction</i>		
DELTA-V POWER PHASE (00:00:03) SPS firing	193:35:10	
<i>15.4 Third Midcourse Correction thru SM Jettison</i>		
<i>15.4.1 Coast to SM Jettison</i>		
DELTA-V VERIFICATION (00:05:00) Confirm delta-V acquisition with GOSS SPS, SM-RCS securing after delta-V BEGIN POST-DELTA-V SYSTEMS CHECK (00:20:00)	193:35:13	
IFTS, G&N, SCS, EPS, ECS, SPS, CES, C&I END REST CYCLE	193:56:00	
DON PRESSURE SUITS (00:15:00)	194:00:00	
BEGIN NAVIGATION SIGHTINGS (00:45:00) Navigational sighting No. 1 - (IMU on operate)	194:14:00	
Obtain trajectory error & ephemeris miss-distance data		
Navigational sighting No. 2 (IMU on operate)		
Obtain trajectory error & ephemeris miss-distance data		
Navigational sighting No. 3 (IMU on operate)		

<i>CSM</i>	<i>h:m:s</i>	<i>LEM</i>
<i>15.4.1 Coast to SM Jettison (cont)</i>		
Obtain trajectory error & ephemeris miss-distance data		
START ENTRY CHECKLIST (00:10:00)	194:50:00	
G&N pre-entry		
SCS pre-entry		
Entry parameters determination		
START CM/SM SEPARATION CHECKLIST (00:30:00)	195:00:00	
CSM separation parameters determination		
IPTS, SPS, CM-RCS, SM-RCS		
ECS fine alignment for delta-V		
CM/SM separation preparation		
<i>15.4.2 Jettison SM</i>		
JETTISON SM (00:01:18)	195:31:19	
Monitor separation		
<i>15.5 SM Jettison to Entry</i>		
POST-SEPARATION OPERATIONS (00:03:00)	195:32:38	
CM attitude maneuver		
IPTS, EPS, ECS, CES checks		
START FINAL ENTRY CHECKLIST (00:07:00)	195:35:38	

CSM	h:m:s	LEM
<i>15.5 SM Jettison to Entry (cont)</i>		
CM-RCS		
G&N & SCS		
CM entry attitude orientation		
Final G&N & SCS entry preparation		
LOSE GOSS COMMUNICATION (Carnarvon)	195:47:24	
<i>16.0 Entry (400,000-ft Altitude to Drogue Chute Deployment)</i>		
PENETRATION OF 400,000-ft ALTITUDE	195:52:38	
Initial entry operations		
0.05g EARTH ATMOSPHERIC THRESHOLD (00:00:30)	195:53:10	
0.05g earth threshold operations		
RANGE CONTROL MANEUVER (00:01:15)	195:53:56	
Primary entry operations		
GLIDE MANEUVER (00:07:04)	195:59:46	
Glide maneuver operation		
EIS ARMING (100,000 ft)	196:03:58	
EIS arming sequence		
<i>17.0 Parachute Descent (Drogue Deployment to Touchdown)</i>		
DROGUE CHUTE DEPLOYMENT (25,000 ft 1 second) (00:00:01)	196:07:37	

CSM	<i>h:m:s</i>	LEM
<i>17.0 Parachute Descent (Drogue Deployment to Touchdown) (cont)</i>		
Mortar deployment of drogue chutes FORWARD HEAT SHIELD DEPLOYMENT (25,000 ft)	196:07:37	
Pyrotechnic deployment of forward heat shield		
PILOT CHUTE DEPLOYMENT (15,000 ft) (00:00:36)	196:08:13	
Mortar deployment of pilot chuts MAIN CHUTE DEPLOYMENT (00:00:41)	196:08:17	
Main chute deployment		
RECOVERY COMMUNICATION SYSTEMS ACTIVATION (00:02:00)	196:09:36	
Operational activation of VHF system TERMINAL DESCENT CREW SYSTEM CHECK (00:03:00)	196:10:37	
Crew safety operation		
<i>18.0 Post-Landing thru Spacecraft Retrieval</i>		
TOUCHDOWN (00:00:15)	196:18:17	
Touchdown operations		
POST-TOUCHDOWN DEPLOYMENT OF RECOVERY AIDS		
Activation of CM recovery communication system		

CSM	h:m:s	LEM
<i>18.0 Post-Landing thru Spacecraft Retrieval (cont)</i>		
CM PREPARED FOR BACKUP		
Post-touchdown activity		
RETRIEVAL		
Crew rescue		
Retrieval of CM by recovery forces		